

RADIO ENGINEERING

*The Technical Magazine of the
Radio Trade - Edited by M.B. Sleeper*

Shielding—for Efficiency

JULY, 1926

What Is Actually Accomplished by Shielding

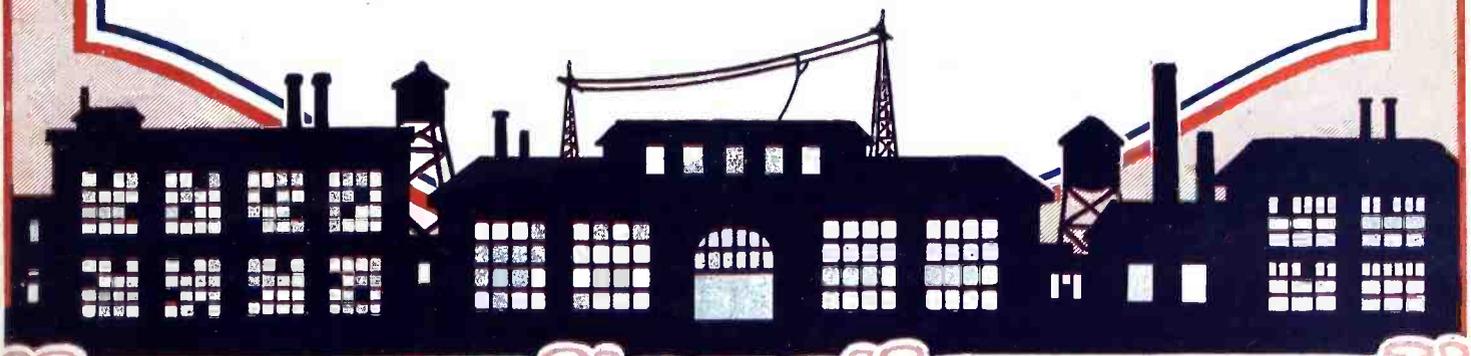
Quantitative data on distortion caused by unstable circuits,
and shielding methods employed to prevent this action

Combination Circuit for B Eliminator Filter

Describing the construction of an eliminator which combines
tuned and brute-force circuits for filtering out the A. C. hum

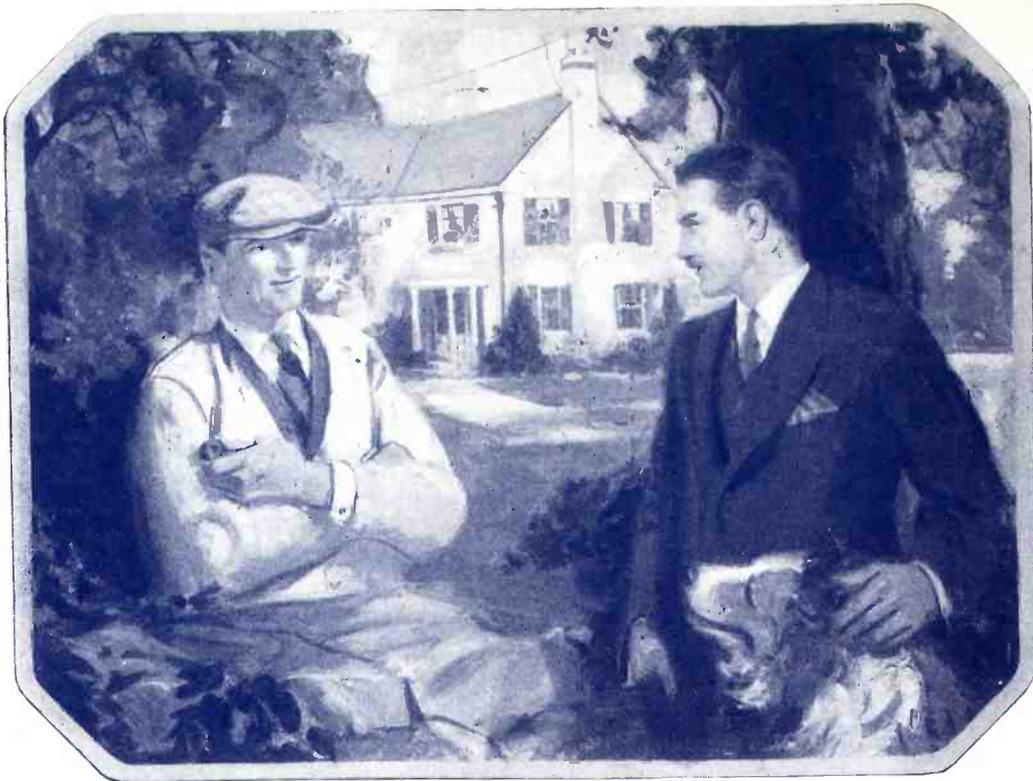
Manufacturers' Data on Eliminator Circuits

Giving official circuits, constants and specifications from
the manufacturers of B battery eliminator equipment



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VOLUME VI NUMBER 7
Sixth Year of Publication



“We give our sets about the same amount of use, but your ‘B’ batteries always last longer than mine. What’s your secret?”

“WHY, there’s really no deep, dark secret about it. It’s simply knowing what are the right size batteries to buy for your set.”

“Yes, but what do you mean by right size?”

“The right size depends on the number of tubes in your set. The more tubes you have, the bigger the ‘B’ battery you need to give you long, economical service. Just follow the rules laid down by Eveready and you can’t make a mistake.” These are the rules and the results:

On all but single tube sets—connect a “C” battery. The length of service given below is based on its use.*

On 1 to 3 tubes—use Eveready No. 772. Listening in on the average of 2 hours daily, it will last a year or more.

*NOTE: A “C” battery greatly increases the life of your “B” batteries and gives a quality of reception unobtainable without it. Radio sets may easily be changed by any competent radio service man to permit the use of a “C” battery.

On 4 or more tubes — use the Heavy-Duty “B” Batteries, either No. 770 or the even longer-lived Eveready Layerbilt No. 486. Used on the average of 2 hours daily, these will last 8 months or longer.

The above rules will give you the maximum of “B” battery life and

economy. Of course, if you listen in more than 2 hours a day, which is the universal year-round average, your “B” batteries will not last quite so long, and if you listen less they will last longer. Eveready “B” Batteries give a pure, steady, noiseless current, the kind of current that is absolutely essential if you prize pure tone.

Send for booklet, “Choosing and Using the Right Radio Batteries,” sent free on request. There is an Eveready dealer nearby.

Manufactured and guaranteed by
NATIONAL CARBON CO., INC.
 New York San Francisco
 Canadian National Carbon Co., Limited
 Toronto, Ontario



LEFT - No. 486, for 4, 5 or more tubes, \$5.50.
 RIGHT - Eveready Dry Cell Radio “A” Battery, 1½ volts.

EVEREADY
Radio Batteries
—they last longer

Tuesday night means Eveready Hour—8 P. M., Eastern Standard Time, through the following stations:

- | | |
|------------------|--------------------|
| WEAF—New York | WSAI—Cincinnati |
| WJAR—Providence | WTAM—Cleveland |
| WEEL—Boston | WWJ—Detroit |
| WTAG—Worcester | WGN—Chicago |
| WFI—Philadelphia | WOC—Davenport |
| WGR—Buffalo | WCCO { Minneapolis |
| WCAE—Pittsburgh | { St. Paul |
- KSD—St. Louis

bring your radio set up to date

for greater distance
for bigger volume
for finer tone ~ ~

NEW RADIOTRONS—new performance—better radio! By keeping up with the progress of the Radiotron laboratories, you can get new results with your old set—keep it up to date. If you have a storage battery set, here is the way to equip it now, to make it many times better:

1. Distance! Take out the detector tube and put the new RCA Radiotron UX-200-A in the socket. This newest development of RCA research means greater sensitivity—longer distance reach.
2. Quality! Put all genuine RCA Radiotrons UX-201-A in the radio frequency sockets, and the first audio stage.
3. Volume, and finer tone! Use either power tube, Radiotron UX-112 or Radiotron UX-171 in the last audio stage, for volume—full, clear-toned volume.

With the laboratories of RCA, General Electric and Westinghouse steadily at work to develop Radiotrons, radio reception is being improved year by year. Many of these improvements can be made right in your old set. Keep pace with Radiotrons. And, for your own protection, always look for the RCA mark on the base and inside the glass of every tube you buy.

RADIO CORPORATION OF AMERICA
New York Chicago San Francisco

RADIOTRON
UX-200-A—
special detector
tube for storage
battery sets.



RCA Radiotron

MADE BY THE MAKERS OF THE RADIOLA

EDITORIAL

ASITUATION has developed this summer which is of great importance to manufacturers of radio sets and radio parts. The first signs of it came from the companies making complete sets.

There was a general understanding that 1927 model sets would be ready on July first. At that date, some were and some were not.

Checking up, we found that those who were not ready were waiting to see exactly what the others had done before committing themselves definitely as to circuits and mechanical details.

Going farther, we found that those who were willing to go ahead on their own judgment, rather than on the judgment of their competitors, were the ones who controlled their own production in plants now equipped to make practically every part except those involving very special processes.

Now, these concerns include practically all those who are established in the trade, and who are financially sound. This leaves the work-bench-and-soldering-iron factories, where parts from other companies are simply assembled into sets, pretty much out in the cold not only in merchandise competition but in price competition.

Furthermore, it leaves the parts manufacturers with a greatly reduced market for their products unless they are willing to take the credit risk of selling the set-assembling companies. This applies, of course, to competitive parts not protected by patents.

This fall everyone is watching the parts companies to see what they are going to do. Those who have the fallacious notion that there is no more consumer business on parts, that set-building is all over, might feel that they will just quit or turn to other lines.

But those who have a real perspective of the industry can see more business and more profitable business ahead for those who can combine merchandising and advertising ability with manufacturing skill.

Consider, for example, that the sales of the S. S. Kresge Stores, where the highest price is \$4.99, are greater than that of the largest radio jobber in the country. The largest and best equipped radio factory in the world sells its output to Kresge, and that is only one of many sources of supply for the Kresge Company.

The prices, the quality of merchandise, the completeness of the stock, and the genuine customer service of a Kresge radio department makes the biggest gyp store on Cortlandt Street look as if it's five years behind the times.

Much of the success of the Kresge stores is due to the fact that they adhere, throughout the season, to the lines with which they start, and back up these lines with construction books and blue prints.

And there is the lesson of literature for both manufacturers and parts dealers. Books and blue prints are absolutely essential to quantity parts sales. Independent dealers are learning to demand good construction sales helps, and the manufacturers who will replace lost sales to set companies by profitable consumer business are working seriously on this sales job.

Moreover, they are almost ready to discover that parts and construction kits have to be sold on the basis that the fun of radio is building your own, on the hobby idea—not in competition, on price or performance, with complete sets.

Watch the clever parts manufacturer this fall, and you'll see some new ideas in advertising and merchandising. Those who aren't lining up their sales plans that way, either independently or in cooperation with others who make non-competing parts, won't last through the season.

M. B. SLEEPER, *Editor.*

RADIO ENGINEERING

The Technical Magazine of the Radio Trade

Edited by M. B. SLEEPER

Vol. VI. JULY, 1926 No. 7
Sixth Year of Publication

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In the August Issue

The first engineering article describing the technical features of the big Zenith receiver will appear in RADIO ENGINEERING for August. Detailed photographs will show how the set is built and why such remarkable results have been obtained with it.

No one ever heard of a C battery eliminator, but Mr. Dallin, of the Acme Apparatus Company has given us the circuit and constants for one and has explained why a C battery eliminator is an important adjunct to a B battery eliminator in locations where the voltage of the supply line fluctuates.

In August you will also find articles on the Grebe short wave receiver, a power supply unit for the US-76 short wave transmitter, a new idea in radio construction sets, using the Benjamin coils, and we have been promised some new things designed by McMurdo Silver. If they come in time, they will make another particularly interesting construction article.

In the September Issue

September will have advance news about a great many things that RADIO ENGINEERING has been working on all this summer, and about which not more than half a dozen people have heard so far.

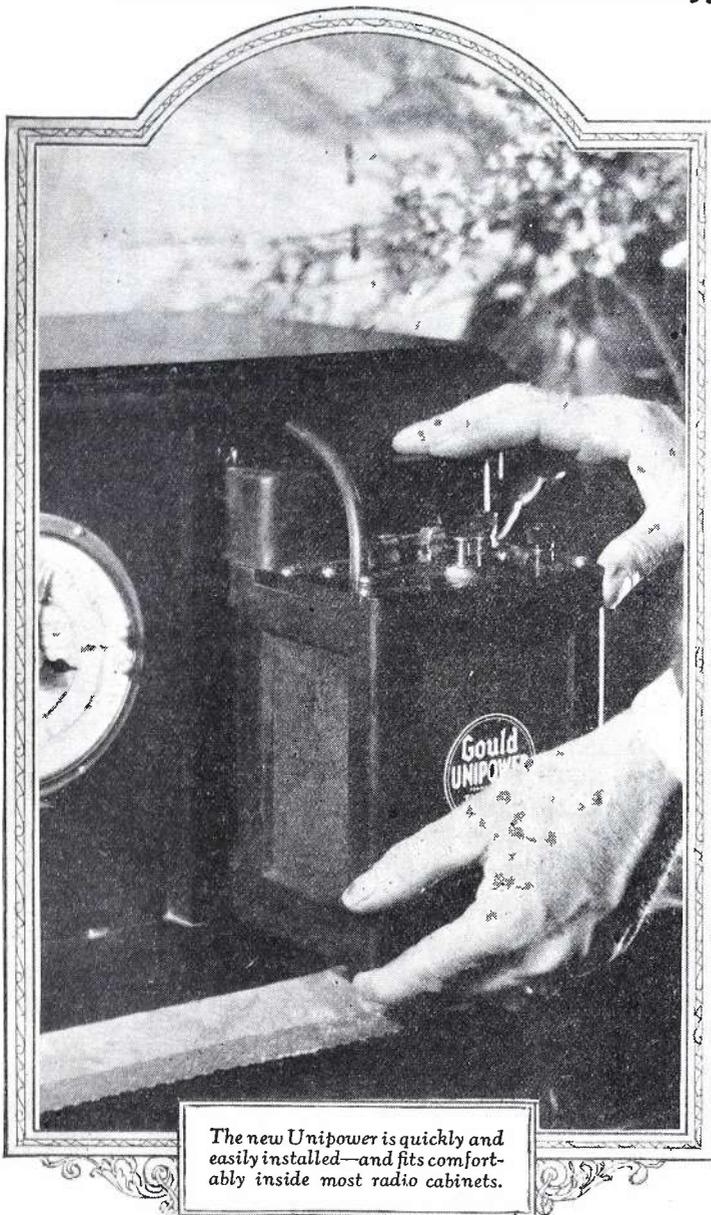
They have to do with a number of different things which are interesting to the technical men and set builders, and will make the September number more useful than ever before.

RADIO ENGINEERING

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The Pioneer "A" Power Unit

is now a recognized basic improvement in radio



The new Unipower is quickly and easily installed—and fits comfortably inside most radio cabinets.

The first cost is the last!

Unipower's first cost is moderate—and the first cost is the last because Unipower contains no tubes, bulbs, lamps; nor any working parts that require frequent and expensive replacement. Unipower will last for years. Compared with dry "A" battery operation, Unipower pays for itself over and over again.

The standard Unipower operates from alternating current, 110-125 volt—60 cycle. The 4-volt type is for sets using 199 tubes or equivalent and retails for \$35.00. The 6 volt type is for sets using 201-A tubes or equivalent and retails for \$40.00. West of the Rockies, prices are slightly higher. (Special models, 25-50 cycle are available.)

FREE! Write for interesting booklet, "Unipower, a triumph in radio power."

Radio Engineering, July, 1926

THE failure of "A" batteries—the constant recharging and replacing of storage batteries and dry cells—these are frequent worries that have caused one of the most serious problems in radio. Now they are eliminated. The important problem of "A" power supply is finally solved.

Three years ago the engineers of the Gould Storage Battery Company developed a new source of permanent "A" current power—the "trickle charge" principle. The result was Unipower—radio's first complete "A" power unit. The "trickle charge" principle, perfected in Unipower, has received the unqualified endorsement of both the Institute of Radio Engineers and the Associated Manufacturers of Electrical Supplies.

Automatic control of set and power

More than merely the pioneer "A" power unit, Unipower is a basic improvement in radio. It improves tone quality. It furnishes unflinching power. It is the only unit employing the "trickle charge" principle that also provides for rapid charging. It gives fool-proof automatic control of both set and power supply, regardless of the type of "B" power used.

Attempts have been made to duplicate Unipower. But the real reliability of such a "trickle charge" installation depends upon the proper relation of all elements involved. Simply to approximate the "trickle charge" principle does not mean that the battery will not become overcharged, or that the "A" current supply will not fail when it is wanted most.

In Unipower only are all these features incorporated. In Unipower only have those qualified to know found the final answer to the "A" power problem.

THE GOULD STORAGE BATTERY CO., Inc.
250 Park Avenue
New York

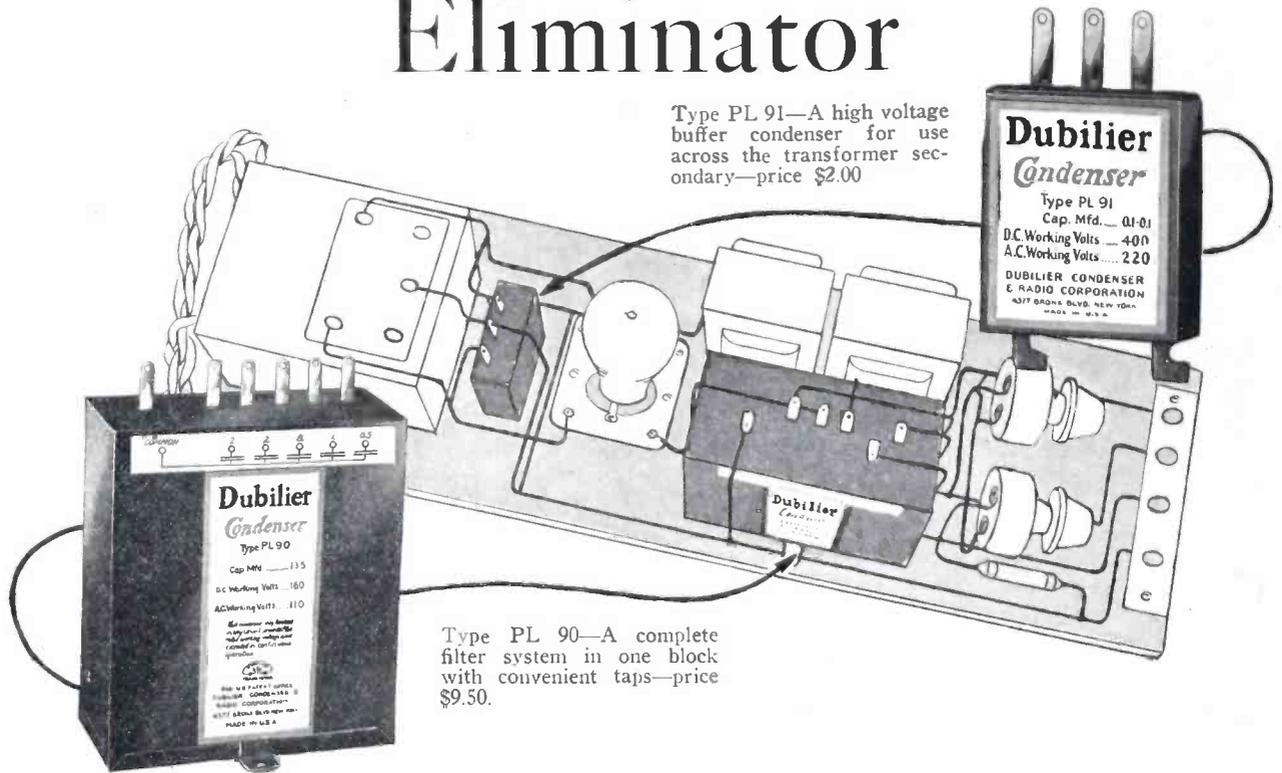
Unipower

Off when it's on ~ On when it's off

Page 267

Use Dubilier Condensers in your Raytheon Eliminator

Type PL 91—A high voltage
buffer condenser for use
across the transformer sec-
ondary—price \$2.00



Type PL 90—A complete
filter system in one block
with convenient taps—price
\$9.50.

These new Dubilier condensers will make your Raytheon "B" Battery eliminator better.

Type PL 91, is a .1—.1 buffer condenser to be used across the secondary of the 110 volt input transformer.

Type PL 90, contains all condensers needed in the filter circuit, and is tapped at 2, 2, 8, 1 and .5 mfd.

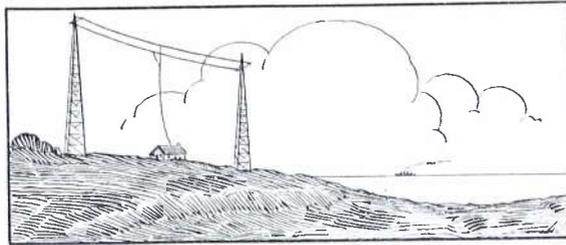
Dubilier condensers are specially designed and constructed to withstand the high voltages used in "B" Battery eliminators. They are the finest condensers obtainable for this purpose.

Send 10c for our booklet, which shows fourteen ways in which you can improve your set by simple application of Dubilier condensers.

4377 BRONX BLVD., NEW YORK, N. Y.

Dubilier

CONDENSER AND RADIO CORPORATION



S. L. T. CONDENSERS

*Discussing the effect on tuning of condensers designed to combine the advantages of the separate "straight-line" types—By S. Cohen**

IF TEN broadcasting stations of equal power were located at points equally distant from your receiving set, and if they transmitted at frequencies 20 K.C. apart, a straight-line frequency condenser would give the most perfect and satisfactory tuning.

Again, if they were all long wave stations, operating from 500 to 600 meters, the straight-line-capacity condenser would provide the best separation.

And to take a third case, if these ten stations were operating on wave lengths 10 meters apart, the straight-line-wave length condenser would distribute the stations equally around the dial.

In actual practice, not one of these three conditions is ever met exactly. A variable condenser can be designed to bring together or separate stations at any part of the condenser scale. The problem is not necessarily that of producing straight-line calibration of one sort or another, but of producing a rate of capacity-change which gives a reasonably even distribution of stations over the dial.

Any condenser with off-set plates can be considered the equivalent of a variable ratio gear applied to a

*Chief Engineer, General Instrument Corporation.

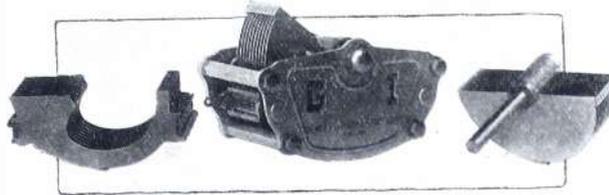


Fig. 1. Separate stator and rotor units of the S.L.T. condenser, and a view of the assembled instruments

straight-line-capacity condenser. As the dial is turned, the capacity is changed at varying rates of speed.

The Metralign condenser, Fig. 1, was designed for straight-line-tuning. That is, an even separation of the stations. Other factors were considered, particularly the mechanical strength and ruggedness, on account of which several new features were introduced, as will be explained later. However, the primary consideration was the present allocation of frequencies to the broadcasting stations.

What actually happens is shown in Fig. 2. A typical assortment of stations was selected—just what hundreds of thousands of people in New York tune in every night.

The vertical lines indicate the number of divisions on a 100-division dial between each station. A condenser giving perfect separation would produce lines in Fig. 2 all of the same length. That is not possible, of course, and if it were, the stations to be heard

in another city would be somewhat different in distribution anyway.

At the same time, there is a very definite difference in the separation effected by the different types, as the lines show, and the accuracy of the statements made in the first three paragraphs of this article is borne out by the chart.

The S.L.C. condenser is obviously objectionable, the S.L.W. condenser is but slightly better, the S.L.F. condenser is a further improvement, the combination type, designated as S.L.T., is most nearly perfect.

A calibration curve of the Metralign S.L.T. Condenser shows that it gives S.L.T. tuning from 0 to 50 divisions, S.L.W. tuning from 50 to 80 divisions, and S.L.C. tuning from 80 to 100 divisions. This can be checked by reference to the chart in Fig. 2.

More of the story is told in Figs. 1 and 3. The accepted low-loss design has been employed, with Radion insulating posts to support the stator plates. The rotor is semi-circular in shape, with the cut out part in the stator. That was done to keep down the panel space covered by the rotor plates.

Extreme ruggedness in the stator unit is obtained by four-point suspen-

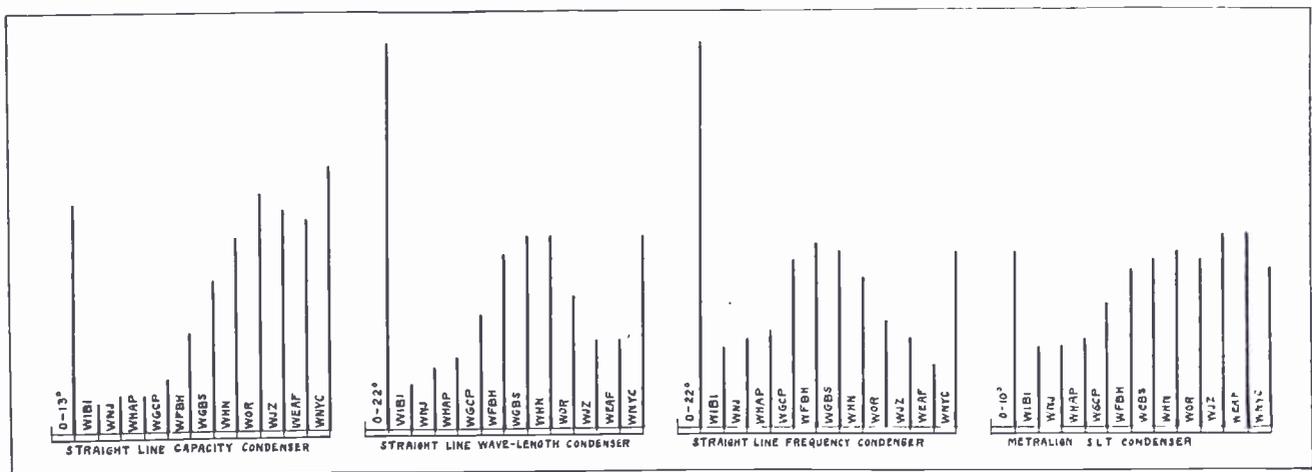


Fig. 2. The length of the vertical lines indicates the distance the dial must be turned to tune from one station to the next

sion. The plates are fitted into slotted strips at each end, at the center on the outside, and at the pointed part inside. The rotor has three-point suspension. There are the spacers on the shaft, the strip on the outside at the right, and another set of spacers inside the plates. That is made possible by the cut out shape of the stator. The added suspension points on the rotor and stator absolutely assure permanence of calibration, a feature of particular importance when the shafts are coupled together for single-control tuning.

Until an entirely new system of wavelength-allocation is determined upon by the Department of Commerce, variable condensers must be designed for air conditions, rather than to meet an arbitrary calibration curve.

The Equimatic System

A TREMENDOUS amount of interest is evident among set and kit manufacturers in the Equimatic receiving system. Already kits and sets are being designed for fall delivery by some of the larger concerns, and others, to whom the details of the method have been disclosed, are making final tests.

The important feature of the Equimatic equipment is that it automatically equalizes the radio frequency amplification over the entire wavelength range. It is well known that sets tend to oscillate at low wavelengths, and fall off badly in amplification at the upper end of the range, giving normally good results only around the middle of the band.

This fault is overcome by the Equimatic system, and, in so doing, other operating conditions are improved.

There is still opportunity to obtain licenses for the Equimatic system, although very little time remains because licenses which are still un-issued will be taken up well in advance of the time for fall production.

Cunningham Tube Equivalence

Some confusion has arisen concerning the Cunningham tube equivalence of Radiotrons, since the introduction of a number of new types.

All Cunningham tubes have C for the first letter of the type number instead of U, as is the case with Radiotrons. Where the X type is used, they are designated as CX. Then, add 1 to the first figure of the numerals.

In other words, the UX-201-A is translated into UX-301-A, but the UV-199 is C-299.

This simple rule will be found helpful in determining the type numbers for Cunningham tubes when only the Radiotron numbers are known.

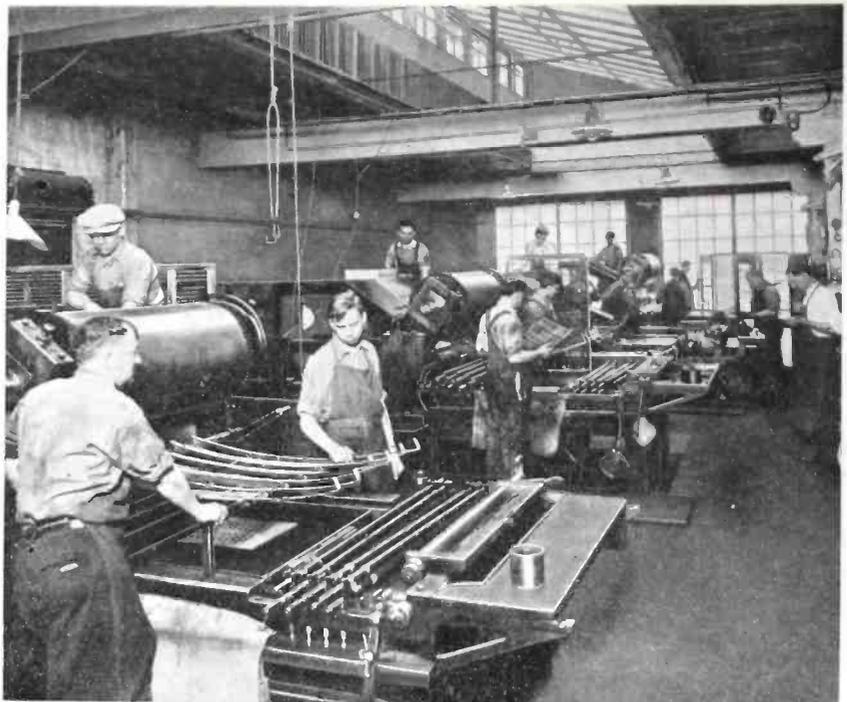


Fig. 1. Designs and lettering, made from original drawings by artists skilled in this work, are applied to the metal panels in lithographic presses

Manufacturing Metal Panels

*Glimpses into the processes by which metal panels are blanked out and decorated—By C. F. McLaughlin**

THE manufacture and decoration of etched metal panels involves the labor and skill of such a surprising number of crafts and trades as to invest this recently developed branch of the radio industry with a degree of interest wholly unexpected to one who has never before investigated metal etching as a commercial art.

This diversity of processes, all contributing to the one finished product, is astonishing to those who are acquainted only with the finished panels. Among the many manufacturing units employed by the Crowe Name Plate and Mfg. Co., in whose plant the accompanying photographs were taken are a completely equipped printing plant for offset printing and lithography on metal; an extensive punch press department for machining, blanking and shaping metal products; a department in which are made the required tools and dies; and departments for sheet metal bulging, lacquering, plating and finishing; not to mention the large areas devoted to the various processes of chemical etching. To provide for rapid increases in productive capacity at the peak of the radio manufacturing season, several of the major departments are duplicated in two distinct units, each complete in itself.

As far as practicable, all panel pro-

*Crowe Name Plate & Mfg. Co., Chicago.

duction is handled in departments specifically devoted to panels, as distinguished from the other types of etched products made by the Company, thereby providing in effect a distinct factory organization for serving the panel requirements of set makers. In addition, the Company maintains an art department, in which are produced the original drawings for plates and panels; specially designed equipment for producing the printing plates or transfers used in offset printing, and a laboratory, in charge of a qualified chemist, where innovations and improvements are in constant development.

The metals best adapted for radio panels are brass and bronze the electrical properties of which, as applied to radio, were thoroughly analyzed in the February 1926 issue of RADIO ENGINEERING. While the adaptability of metal as a panel material was long known to radio engineers, the problem of engraving suitable markings, scales and decorations on metal, together with that of attaining desirable finish effects for use on high-class receivers, prevented the general use of metal panels until the etching process was applied and found eminently adapted to the peculiar requirements of the radio industry. By the etching process, which has been utilized on a commercial basis in this country for perhaps less than a quarter-century, the



Fig. 3. Panels are set up to dry and are moved about the factory in specially constructed racks

characters and decorations are brought out in relief by etching away the background or undecorated surface of the metal, to which the required design and lettering have first been transferred by offset lithography. The lettering and decorations thus become an integral part of the metal, and not being applied by means of enamels, inks, or bronze powders, nor their permanency dependent on surface lacquers, the durability of this form of engraving is readily apparent.

To meet the varying requirements of consumers of etched metal products and radio panels entails carrying in stock many tons of sheet metals—bronze, brass, aluminum, zinc, nickel silver—in many different widths and thicknesses. These metals are received from the mills in strips or sheets, packed in cases of considerable bulk. The first step in the manufacture of the metal panel—after completing the design and printing transfer—is the preparatory work on the mill sheets. To facilitate quick handling in the plant, the mill sheets are transported by means of a traveling crane from the stock room to the preparatory department, where they are cut into the required sizes for processing, and undergo the necessary grinding or buffing to provide the proper surface for any desired finish. From this preparatory stage the metal goes to the printing room, a section of which is shown in Fig. 1, to receive by offset lithography from previously prepared plates an impression of the design or lettering which is to be etched on the panel.

From the printing department, save for certain intermediate steps occasioned by different finishes, the panels progress to the etching department. This chemical etching is perhaps the most interesting and highly specialized process in the manufacture of metal panels. Various chemical solutions

and methods of treatment are, of course, required for different metals and to produce variations in finish. These solutions are contained in large vats or tanks into which the panels are immersed to undergo the etching process.

Next, in the line of major operations, are the machine work and finish-

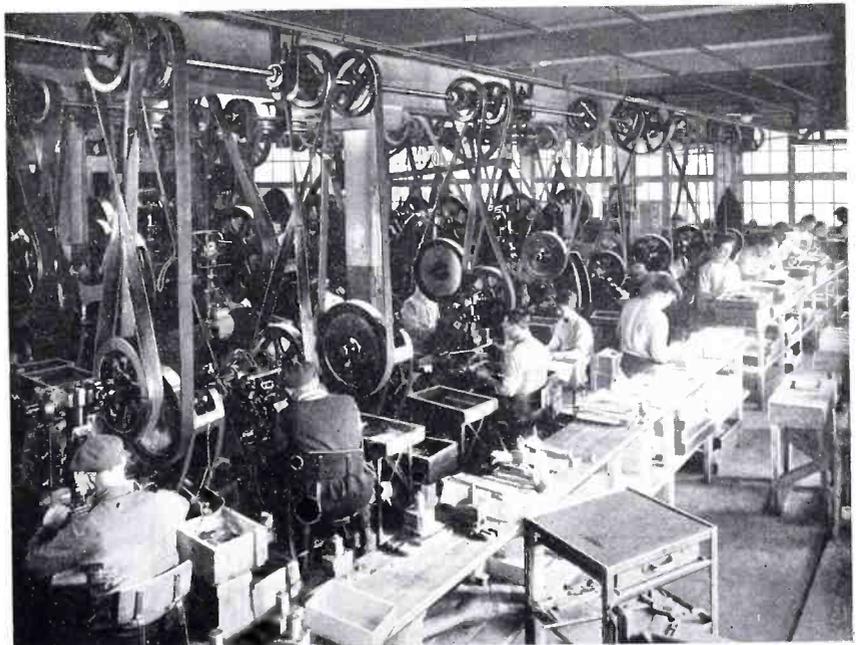


Fig. 2. A part of the stamping department, where holes are punched and special shapes stamped into the panels

ing. A view of the machine and punch press department, Fig. 2, will convey an idea of the extensive facilities utilized for such mechanical details as cutting to size, blanking, piercing, and forming the etched and sheet metal products of the Crowe factory, which, in addition to radio panels, dials, and

plates, include many millions of name plates for the machinery, electrical, automobile and kindred industries.

Special equipment and powerful presses are assigned to radio panels, the holes and openings in which are pierced at one stroke from multiple punches, thus insuring absolute accuracy as to location. Similar equipment is used in producing panels with formed openings, escutcheons or counterpunchings, for receivers having dials mounted behind the panel.

Among the new sets for this fall, there are several different design systems. Some sets are made with a cast metal chassis, generally aluminum, to carry the weight of the various parts, so that the metal panel is simply used as an instrument board. Other outfits, using heavier front panels, have all or a part of the instruments supported by the front panel. In that case, the front panel is securely fastened to the wooden cabinet.

Many of the sub panels are being stamped from metal. There is economy in this arrangement particularly because all machine work is eliminated, and because no individual fitting is required when the set is assembled. Since solid stamping dies are used, absolute uniformity is maintained, and there is no wear, as is the case with drilling jigs, which may bring the holes out of place.

Some of the sub panels are finished with etching of various sorts, while others use the plain metal buffed to an attractive finish.

The making of metal panels represents a new art, which has called forth new phases of productive energy and skill, and the amplification of these elements in an old and established industry emphasizes the growing importance of radio as an industrial factor in widely diversified fields.

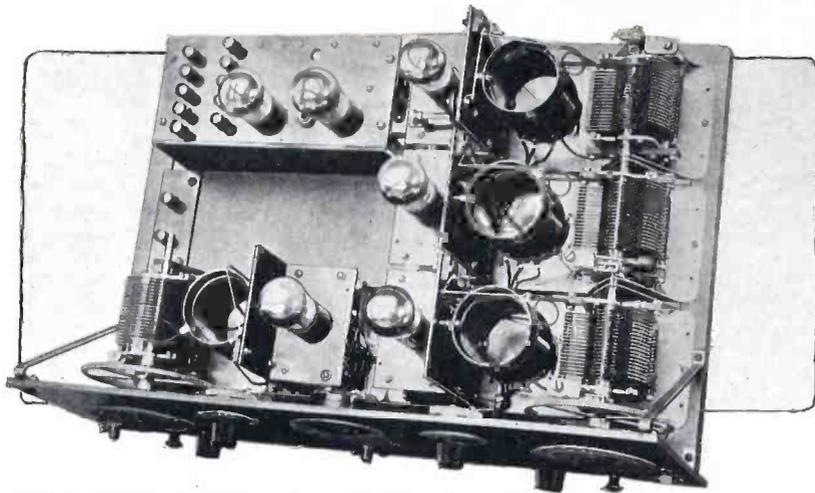


Fig. 1. The assembled receiver with the covers of the four tuning units removed. The exact construction of the shields is shown in Fig. 7

Why Sets Are Shielded

*Explaining the use of shielding to obtain more R.F. amplification, selectivity, and freedom from distortion—By Ray H. Manson**

IN deciding upon the use of total shielding in its receivers, the Stromberg-Carlson Company had three main objects in view; increased power, adequate selectivity, and a nearer approach to perfect tonal reproduction. The first was made necessary by the advent of the cone type of producer, the second by the increased congestion of the wave bands, and the third by the demand of the public that the radio receiver take its place in the home as a musical instrument.

An increase in power could have been obtained by an additional stage of audio amplification but this would not have improved tone quality or increased distance ability perceptibly, which was our aim. It was decided that whatever increase in power was to be made should be made in the radio end of the receiver. Working upon the standard five tube Neutrodyne circuit as a foundation, the problem resolved itself into the addition of another stage of radio frequency amplification. It was through the experimentation along this line that the Stromberg-Carlson system of total shielding was developed.

Cascade amplification, as exemplified in the two-stage and three-stage receiver, requires several tuned circuits to be coupled together through vacuum tubes. To avoid regeneration and the resultant disturbing oscillations, it is necessary to eliminate all coupling between the successive circuits in order that regeneration will not produce undesirable sharpness of tuning, and uncontrollable oscillations. Prior to Professor Hazeltine's development of the Neutrodyne receiver, the

one coupling which stood in the way of successful cascade amplification was the coupling introduced into the vacuum tube itself by the capacity between grid and plate. His method of balancing out this capacity effect within the tube has eliminated the undesirable effects of this coupling.

In addition to tube capacity, there is coupling between adjacent radio frequency coils and also between non-adjacent coils as well as capacity effects between the several coils and the antenna, all of which must be neutralized if efficient and stable operation is to be had. In a two-stage receiver, inter-stage coupling can be nullified by tilting the coils at an angle, and capacity effects between antenna and coils are so slight as to be practically negligible. In a three-stage receiver, however, all these must be neutralized. There are four tuned circuits and in order to neutralize all capacity effects, six neutralizations would be required. This would be unweildly and has led to the conclusion that if three or more stages of radio frequency amplification are used, complete metallic shielding is

necessary. In addition to these couplings, there are other incidental ones which must be eliminated to produce a successful receiver and which are also nullified by the shielding.

Briefly then, the advantages of total shielding as applied to Neutrodyne receivers are as follows:

1—Due to the removal of stray capacity and inductive coupling, the use of shielding makes possible the construction of three or four-stage tuned radio frequency amplifiers.

2—With complete shielding perfect neutralization can be obtained.

3—Magnetic or capacity pick-up of interfering signals on intermediate circuits is eliminated.

4—The number of tuning adjustments can be reduced to two, inasmuch as three of the tuned circuits can be tuned by gang condensers. The antenna circuit differs from the others in that no tube precedes it and it was consequently decided to tune the antenna stage by a separate control, making two dials for the four tuned circuits.

This reduction in the number of controls introduces some mechanical problems that require special treatment. It is obvious that all three of the tuning coils in the 2nd, 3rd and 4th tuning circuits must be alike in inductance and that the three associated capacities must match for each setting

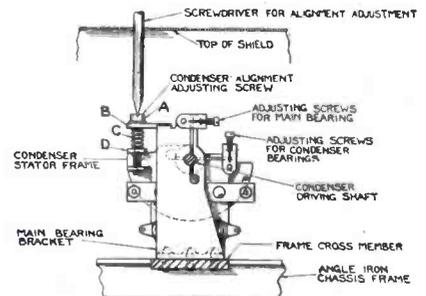


Fig. 3. Mechanism of the bearings and micrometer adjustment

of the station selector throughout the complete scale.

The construction of the tuning system must be such that it will not be disturbed by rough handling during shipment or by subsequent wear of the driving mechanism or by mechanical displacement through temperature changes. The requirement that each of the three condensers be enclosed in

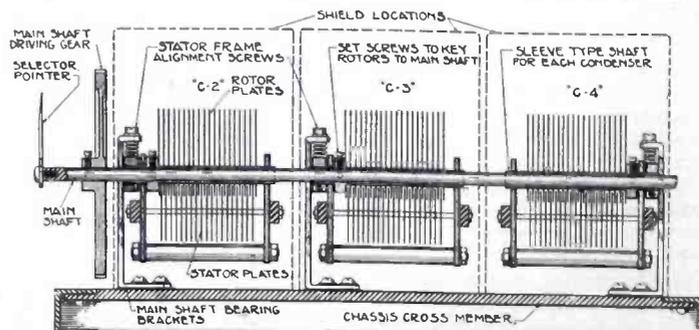


Fig. 2. Details of the triple condenser. Note that the three rotors are adjustably fastened to the solid steel shaft

* Chief Engineer, Stromberg-Carlson.

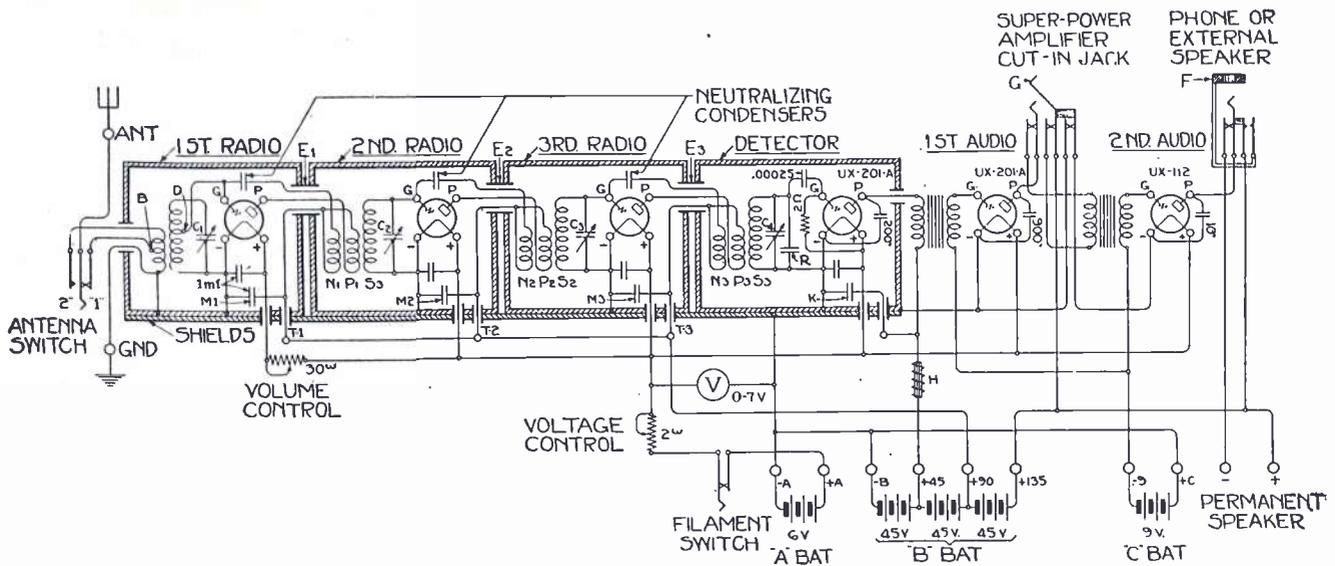


Fig. 5. All the circuit data on the Stromberg-Carlson shielded neutrodyne is given in this diagram

individual shields also complicates the problem. In this six tube receiver these problems have been solved by employing a chassis construction that is entirely new to radio design. A heavy steel angle-iron framework with suitable steel cross members serves as a base upon which all the apparatus is mounted. The complete chassis assembly with tops of shields removed is shown in Fig. 1.

The three tuning condensers shown at the right of Fig. 1 are driven by a solid, one-piece, 5/16-inch steel shaft which extends from the station selector dial pointer through the hollow sleeve-shafts of the separate condensers and the three main shaft supporting bearings as illustrated in the cross-section diagram, Fig. 2. An adjustable, flexible, spring-type bearing is employed to provide against shaft looseness due to wear. This type of bearing adjustment is shown more clearly in Fig. 3. The one-piece driving shaft mechanism is made possible by using a hollow sleeve type of rotor shaft on each tuning condenser, as indicated in Fig. 2. This allows the individual condensers to be assembled and accurately adjusted before mounting, just as for any single variable condenser, and later slid on the one-piece driving shaft and locked to the latter by two steel set screws, Fig. 2. Thus the one-piece shaft serves mainly as a means for revolving the three condenser rotor plate assemblies, providing a positive drive similar to that employed in the full-floating rear axle of a modern automobile.

This scheme of construction is made still more practicable by adjustable fastenings for each condenser frame—stator assembly—to the main driving shaft-bearing bracket, as shown in Fig. 3. An adjustable screw A passes through a clearance hole in the lug B of the main bearing bracket and threads into the lug D of the stator assembly. A spiral spring C serves to swing the assembly counter-clockwise when the adjusting screw is turned

counter-clockwise and vice versa. This provides a simple and accurate means of condenser alignment.

Thus it is that total shielding solves the problems of power and selectivity, the first through the use of a third stage of radio amplification which increases both power and distance ability, the second by forcing the signal from the antenna to pass through four tuned circuits in series before reaching the detector tube.

The problem of faithful tonal reproduction is usually one primarily of the audio system, but in these receivers is one of the radio system also. In transformer coupled audio-frequency amplifiers, the individual transformers must be carefully designed so as to have sufficient impedance at the lower audio-frequencies to prevent a fall in amplification at these frequencies. Also, the distributed capacity and leakage inductance in the secondary must be considered, in order that the transformers shall not have a greatly exaggerated amplification at these higher speech

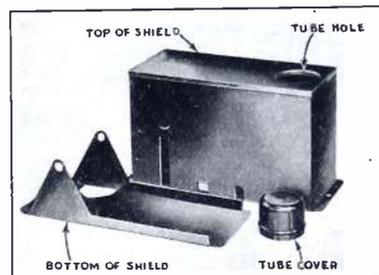


Fig. 7. The three parts of the individual shields

frequencies—the resonant frequency of the secondary leakage inductance with the distributed capacity of the secondary. There are various methods of removing this second peak. It is felt, however, that too much stress has been laid in the past on the frequency characteristic of the individual transformers. The characteristic of the amplifier, as a whole, can be much

distorted by regeneration at audio-frequency. Fig. 4 illustrates some of these effects. Curve A is the characteristic of an amplifier with all regenerative actions suppressed. Curves B and C show the characteristic of the same amplifier with distortion resulting from regeneration due to impedance in the common B current supply. Impedances sufficient to cause this type of distortion may be found in dry B batteries after a few weeks' use or in B socket power devices from the start. This type of distortion is probably the most common source of dissatisfaction with amplifiers now on the market. It can be removed by the use of a separate detector B unit or by proper filter arrangements, which are provided in the Stromberg-Carlson receivers.

Curve D illustrates a distortion arising from capacity coupling between the output of the last tube and the detector grid, if grid detection is used. This is entirely removed by shielding the detector tube in a metal compartment.

Curve D also illustrates a distortion arising from mechanical regeneration from the loud speaker to the elements of the detector tube. The use of spring cushion sockets is not satisfactory in preventing this type of distortion since the vibration is often transmitted through the air. A felt lined compartment for the detector tube has been found most successful in the receiver described here.

Distortion of this latter type is caused by microphonic action of the radio frequency tubes or even of the tuning condensers. The action is then a modulating one and only occurs when a carrier frequency is present. This is completely overcome by rigid design of chassis and by use of thick condenser plates.

If any of the above-mentioned effects is present to an extent slightly greater than illustrated in Fig. 4, continuous howling takes place. When

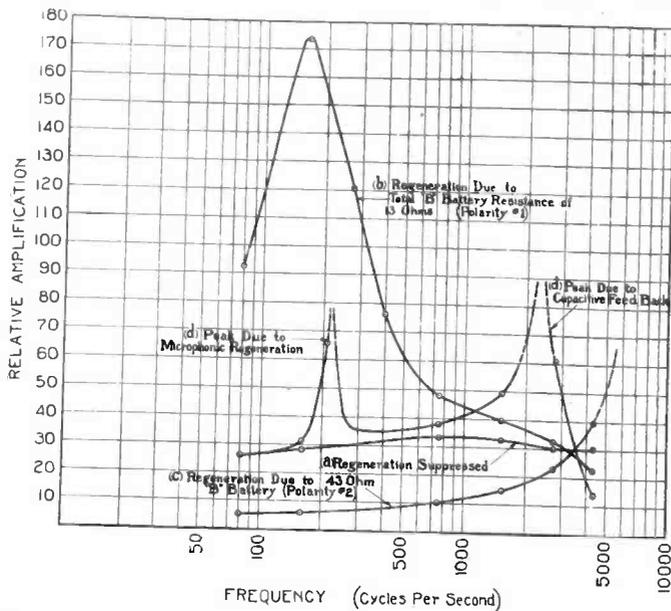


Fig. 4. No matter how perfect the amplification of an A. F. transformer, it can be severely distorted by outside factors, as these curves show

this takes place it is at once apparent. It is possible, however, that distortion may occur from these effects even though no continuous oscillation or howl takes place, unless the precautions cited above are put into practise.

The audio transformers are specially designed to give flat voltage-amplification curve over the range of audio-frequencies that is considered essential to good quality reproduction. The

The neutralizing operations follow the usual practise except that it is not convenient to block the filament connection in the new X-type of tube sockets which are employed in this receiver. Instead, the positive B 90-volt supply wire is disconnected from a terminal, T₁, T₂, or T₃, Fig. 5, provided on the bottom of each of the amplifier shields. By referring to the circuit, Fig. 5, it will be noticed that

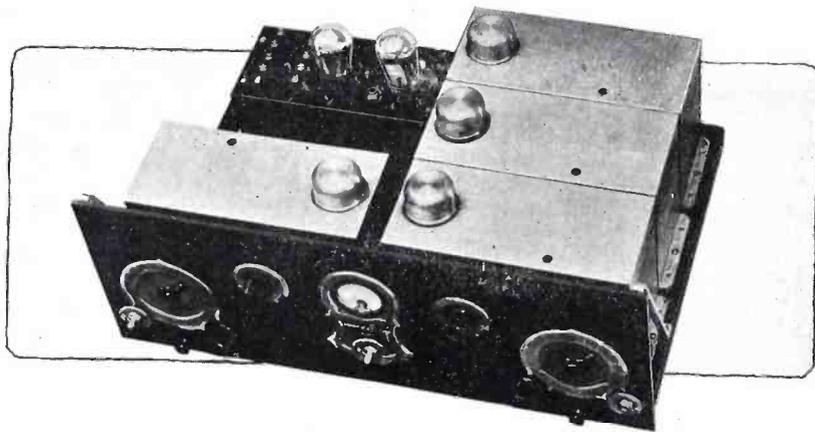


Fig. 6. The shielding is almost 100% perfect. Even the openings for replacing tubes are covered by caps

usual second peak in the amplification curve, previously mentioned in this paper, is removed by the use of a short-circuiting band of copper applied around the outside of the secondary winding.

As shown in the circuit diagram, Fig. 5, both stages of the audio system are connected to the loud speaker output binding posts and output phone jack at all times, thereby including sufficient audio amplification to insure ample volume of loud speaker signal without the common tendency to overload the detector tube.

the radio frequency circuit is left intact when this B battery wire circuit is opened, as it is maintained from the transformer primary winding, P₁, P₂, and P₃, through the 1.0 mfd. by-pass condenser, M₁, M₂, and M₃, to the F terminals of the tubes. Following the alignment of condensers and the neutralizing operations, a calibration curve of each receiver is drawn from points taken on the right hand station selector by means of a wave meter. The shields are then sealed in place and the receiver is ready for shipment. Fig. 6 shows the shields assembled in the receiver.

How to Use the Donle Detector Tube

One of the dangers in introducing a new device is that, through misuse on the part of the purchasers, it may not achieve the reputation it deserves at the beginning.

In some instances which have been brought to our attention, this is true of the Donle tube.

To illustrate—We had a telephone call from the technical man in one of the New York stores. He was very much upset because, after inducing the purchasing department to put in a stock of Donle tubes, the first shipment proved, on examination, to be totally inoperative.

"Oh yes," he said, "I tested them myself, so that I know that every one is defective. The filaments light all right, but they won't work."

"How did you test them?" we asked him.

"Why on a regular tube testing outfit. The regulation instrument we use for all tubes."

"What did the meter show to be wrong with the tubes?"

"They were all open in the plate circuit, apparently, for they showed no plate current at all."

That reply gave us the answer to his trouble. It is not possible to use an ordinary tube testing device for testing Donle tubes because their characteristics are totally different from the conventional detector-amplifier tubes.

In the first place, the Donle tube operates in an entirely different way from the regular tubes. The plate current generally runs around 0.2 milliamperes. Most of the tube testing instruments do not give any readable indication at this value.

Another thing, the grid return makes much more difference with a Donle detector tube than with a 201-A, for example. This is shown in the circular which accompanies the tube, but a great many people seem to feel that they know more about the tube than the manufacturers, and, consequently, make mistakes. The grid return should go directly to the positive filament terminal of the socket.

It is not enough to connect the grid return to the socket terminal marked plus. It is more important to see that the grid return goes to the socket terminal which is connected to the plus side of the A battery.

The grid condenser should be of 0.00025. Our experiences show that results on distant stations are frequently improved by using a gridleak value as high as 10 megohms. On the other hand, for local reception, some experimenters report that the quality is improved by using a grid-leak of 0.5 to 2.0 megohms.

The filament voltage and the plate voltage are sometimes slightly critical, that these valves may require adjustment.

The Bass Note Receiver

An outfit designed by Daven to bring out the full strength of the low notes in the musical scale

One of the nicest jobs we have seen for a long time, in the way of a receiving set design suitable for home construction is an outfit originally made as a test set assembled in the laboratory of the Daven Radio Company.

It was first constructed to demonstrate the ability of a resistance coupled amplifier to reproduce the lower end of the musical scale. So it happened that it was given the name Bass Note Receiver.

The circuit is of the conventional type, correctly designed to operate at full efficiency with resistance coupling. The particular feature about the set, however, is the ease with which it can be assembled and its attractive appearance when completed.

The inductances for the two stages of tuned R.F. and detector are of Daven manufacture, tuned by U. S. Tool single bearing condensers. They have Marco vernier dials on the front panel.

The balance of the equipment is made up with three Benjamin sockets, Daven ballasts, Yaxley rheostat and switch, a Carter jack, and the Daven resistance amplifier unit.

Most of the apparatus is carried on a wooden baseboard. Some sets made this way look rather disorderly be-

cause of the necessity for having all the wiring above the panel. On this outfit, however, it works out very simply and neatly.

Fig. 1 shows three views of the assembled receiver. First is a rear view showing the set complete wired. Hi-Mu tubes are used for the detector and A.F. amplifier. Many experimenters find that the Hi-Mu tube is more sensitive as a detector than the 201-A type. The two R.F. tubes are 201-A's.

The top view is shown at the center. This photograph was taken when only part of the wiring had been done. This illustrates the arrangement of the parts on the base panel. The three binding posts on the left are for long or short antenna and ground. All the battery connections are made to the binding posts on the A.F. amplifier unit. The front view is at the bottom. This arrangement is very neat and simple enough to suit the most exacting.

Altho it is too early to say definitely, so far in advance of the season, it appears probable that a great many set manufacturers will use resistance coupling on tuned R.F. receivers.

Companies who started in last fall with resistance amplification are us-

ing it again for 1927 models, and a number of others have taken it up. The introduction of the new metallic gridleaks has removed a considerable factor of prejudice against resistance coupling, for many engineers did not feel that the paper type gridleaks were sufficiently dependable, owing to their tendency to change in resistance. Now, however, sets can be shipped out with definite assurance that the operation of the A.F. end will not change over a period of time from any changing constants in the resistances.

The tuned R. F. transformers for this set are unusual in that they are of much smaller size than sets of coils previously supplied by other concerns. The losses in the coils are probably so low that the difference between them and the coils of so-called low-loss construction will not show up in the operation of the set. They have the advantage, in being small, of a much smaller electro-magnetic field. The larger the coil, the greater the field around it and the greater the magnetic linkage with other tuning circuits.

At the Radio Engineering Laboratory we are experimenting with coils of very small size to see if it is not possible to maintain low losses and at the same time cut down the mechanical dimensions so as to reduce the field around the coils. A small size is particularly important if the coils are to be shielded.

These Daven coils are a very handy size for those who want to experiment with shielded circuits.

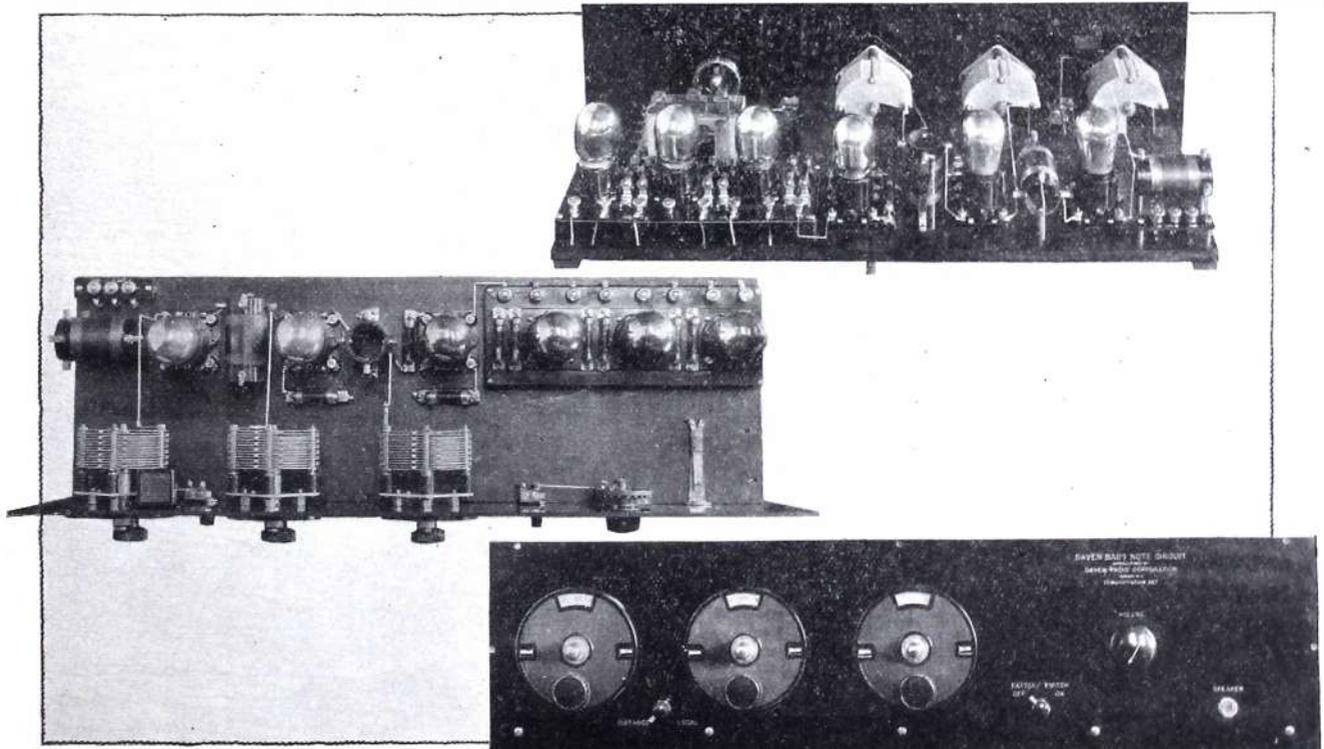


Fig. 1. A laboratory demonstration outfit which developed into a construction design for set builders

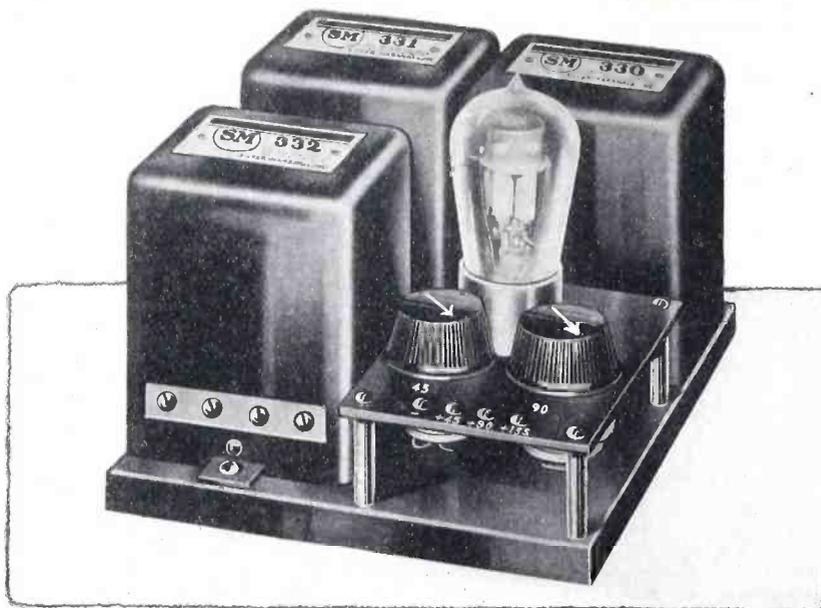


Fig. 1. All the filter circuit parts are contained in the three cases which, with the socket and voltage regulators, are mounted on a metal base, thus eliminating fire risk

A New Eliminator Circuit

An A. C. operated B-eliminator combining the virtues of brute force and tuned filters—By Ernest R. Pfaff

BASICALLY, all supply systems designed to furnish power for the radio receiver from the house lighting mains consist of four units into which component parts may be very easily segregated.

The first section of every eliminator is the power transformer which serves to take the requisite power from the house lighting circuit to which it is connected and step it up to the value which will be required by the radio receiver, plus the additional amount necessary to overcome the losses inherent in the transformer itself, the rectifier device, and the filter system. Connected to the transformer is the second unit, the rectifying device—in the cases under consideration a Raytheon or, as an alternative, a Rectron tube. These tubes serve to convert the alternating current output of the transformer to a direct current of a comparatively uneven or pulsating nature.

Therefore, the third section, the filter, is used to smooth out this pulsating direct current to a substantially smooth continuous direct current, the nature of which is similar to that of the current obtained from ordinary B batteries except that it does not diminish over a period of time as does the battery current as a result of chemical deterioration.

The voltage obtained from the system, so far, is considerably in excess of that required for the operation of all receiver circuits excepting only the power amplifier, or audio ampli-

fying tube, which requires from 135 to 300 volts. Therefore, the fourth section, a voltage regulator, consisting of various resistances and condensers, is employed to cut down this high voltage, where necessary, to the requisite value for detector and radio frequency amplifier tubes. Such a power supply has a pronounced advantage over batteries in that the voltage is practically constant and the life almost unlimited using the Raytheon tube which has no filament to burn out.

A special electrostatic shield—an absolutely new feature in power transformer design—is inserted between primary and secondary windings, thus eliminating much common line noise that would get through to the radio set with ordinary transformers.

The voltage regulation of the transformer is nearly perfect, that is, the voltage will remain almost constant regardless of the current drawn from it, over the ranges used in the largest receivers. One very interesting feature is the fact that if the supply set operated by this transformer is left permanently turned on, but without the radio receiver operating, the current drawn will be less than one-fortieth of an ampere. Further, its normal rating is 85 milliamperes, at which rating it will not heat above room temperature under continuous operation nor will it heat unduly under a 100 per cent overload for a reasonable time period, because of its unusually ample design.

The new type BH 85-milliampere, full-wave Raytheon tube is utilized for rectification since its voltage regulation is excellent, its life extremely long, and its operation more than satisfactory. However, the single-wave or double-wave Rectron tubes may be used, but will require the use of the filament lighting winding of the power transformer, thus not leaving it free to light power amplifier tubes as would be the case with the Raytheon rectifier.

The filter is the most interesting part of the entire outfit. This filter, rather than depending upon brute-force action to eliminate the 120-cycle fundamental hum, which is very strong at the rectifier output, uses a selective section, plus brute-force action, to eliminate this frequency, and for the weaker 240, 480, and 960 cycle harmonics, depends upon brute-force action.

The filter is made up of a unichoke and condenser bank, in identical steel cases. The condenser bank also contains the 1/10th mfd. buffer condensers required across the elements of the Raytheon tube, which really serve as radio frequency drains and bypass condensers, as well as the voltage regulator condensers in addition to the filter capacities proper.

In the circuit, the choke coil will be seen to consist of two windings, one large and one small, wound in opposition upon a common core. Upon the exact characteristics of these windings depends the entire effectiveness of the filter, and its surprising superiority to other systems. The input to the filter from the rectifier is shunted by a 2.0 mfd. condenser

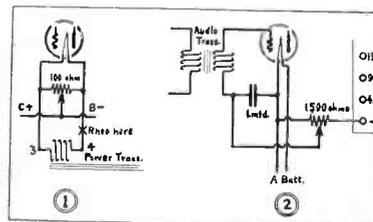


Fig. 3. At 1, connections for a power tube. At 2, connections to the set for the power amplifier

which serves to supply starting voltage for the rectifier tube, and to aid in filtration. Connected from the joint of the opposed inductances in the unichoke to ground is another 2.0 mfd. condenser. This capacity, plus the mutual inductance of the opposed coils, provides a resonant circuit of extremely low resistance which effectively eliminates the 120-cycle hum. The actual resonance curve is sufficiently broad to take care of commercial lighting line variations, yet the resistance is so low that the filtration due to this section alone is marvelous, compared to conventional brute-force methods.

Since the 240, 480, and 960 cycles harmonics are quite weak—the 960 one being almost negligible, a brute-

force effect is used, provided by the unusually high inductance of one winding of the unichoke and the capacities. Across the output of the filter is a 4 mfd. condenser, which, in addition to aiding the filtering action, serves to reduce distortion in the receiver due to poor voltage regulation—a practically unnecessary precaution. This is because of the very low direct current resistance of the unichoke, Raytheon tube and transformer. Thus, the voltage regulation

simple to use a power tube in the last audio stage, lighting its filament from the 3-4 winding of the power transformer. Assuming a UX210 tube to be used, the following procedure may be advantageously followed.

The filament connections from the last audio tube socket in the receiver are disconnected entirely from the set wiring, and, instead, connected to terminals 3-4 as at 1, in Fig. 3, of the No. 330 power transformer by means of a pair of rubber-covered wires

nects to an adjustable contact on the 1500-ohm resistor.

The receiver is now put in operation with the tap on the 1500-ohm resistance at the end farthest from the filament resistance connection. With a signal coming in, the position of this tap is adjusted for best quality. The most satisfactory way to make this adjustment is to connect a millimeter in the plate circuit of the last tube, and adjust the resistance tap until a signal does not cause the meter reading to vary at all, which is the correct adjustment.

If a power tube is used, operating on the full voltage of the supply set, an output transformer really should be used between the speaker and the power tube for insulation purposes. Further, such a transformer will improve low note quality very much, if properly designed, as is the S-M No. 220 output transformer, for this purpose. It will also, by keeping the direct current out of the loudspeaker, increase the speaker's handling capacity several times, in most cases.

Under certain circumstances, it may be well to connect a 1 to 4 mfd. condenser from the center tap of the 100-ohm resistance to the F post of the secondary of the audio transformer in the power stage. Frequently, stability will also be improved if two 1/10th mfd. condensers, with their joint grounded directly to the set ground, have their other

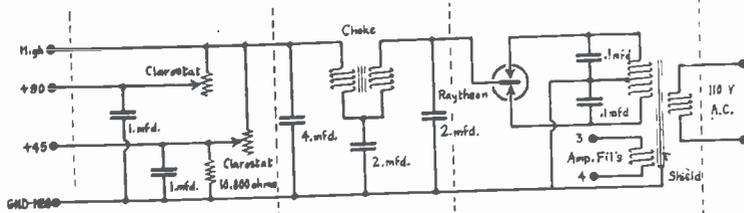


Fig. 2. Complete circuit diagram and contents of the combination circuit B eliminators. Note that terminals are provided for A current to a power amplifier Radlotron rectifier tube filament

curve of the entire supply set is practically a descending straight line—much flatter than in the case of less amply designed outfits. An inspection of this curve will make it evident that the percentage voltage drop for a 90 milliamper load is but 43 per cent.

In order that the maximum output voltage of about 300 can be properly cut down, one fixed, and two adjustable resistances as well as two 1.0 mfd. condensers are used, thus permitting voltages of from 20 up, to be obtained for ordinary receivers. The full voltage of the supply set is only used on power amplifier tubes such as UX112, UX171, or UX210 types.

Once the eliminator has been set in operation, it may be connected to a receiver and put in operation. Several precautions should be observed, however, inasmuch as the supply set is a power device, and must be carefully handled. The detector voltage should be obtained from the binding post marked +45, while the amplifier voltage is taken from the +90 post. Before starting, both resistances should be well unscrewed, and in turning them in, it must be remembered that on an average receiver, the voltage obtained when they are all in will be on the order of several hundred. If a power tube operating on 135 volts is to be used, then an extra Clarostat must be employed in series with the HIGH binding post, as well as an extra 1.0 mfd. condenser connected across the 135-volt and negative B binding posts of the receiver.

This, however, is an arrangement which wastes much of the supply set power, and does not give anywhere near the maximum quality and volume that might be easily obtained. The ideal way to take advantage of the supply set power is to use a UX112, UX171, or UX210 power tube as the last audio amplifier ALWAYS. Even where dry cell tubes are used in the receiver itself, it is entirely

which should be twisted. If a UX171 of UX112 tube were to be used, then a fixed 5-ohm resistance would have to be connected in series with one wire. Next, direct at the tube socket terminals should be mounted a 100-ohm fixed resistance with one end connected to each of the filament posts of the socket. To the center tap of this resistance will be connected the C+ and B— leads as well

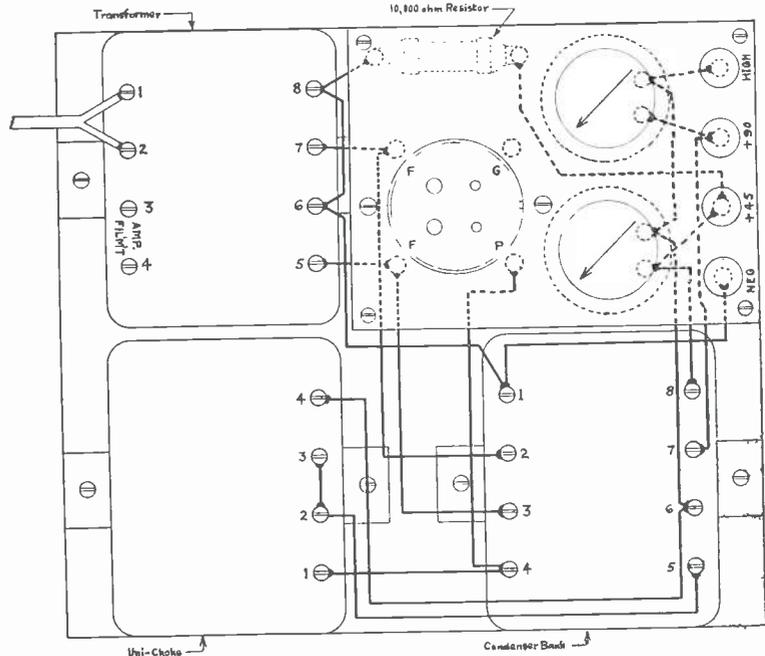


Fig. 4. Picture wiring diagram of the eliminator as it is connected for the Raytheon tube

as the negative filament lead of the other tubes in the set. The receiver is then connected to the supply set with a 1500-ohm adjustable resistance, 2, in Fig. 3, in the common negative lead to the eliminator. The set end of this resistor connects to the center of the 100-ohm resistance shunting the power tube filament, and the C-lead of the power stage con-

terminals connected to the F posts of the Raytheon tube socket. In this case, connecting terminal 8 of the power transformer, the noise shield, directly to the set ground may also diminish noise if troublesome. These suggestions apply only when the 1500-ohm series resistance in the negative B supply lead is used to obtain power amplifier C voltage.

Raytheon B Circuits

This data, furnished by the transformer manufacturers, gives the approved circuits and constants

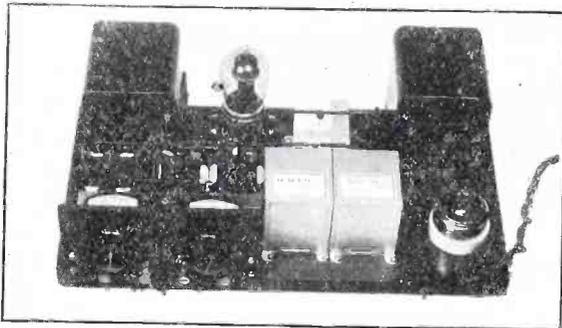
BECAUSE of the various types of Raytheon B Eliminator circuits shown in radio publications, each interpreted in terms of the author's own preference, there

has come to be much misunderstanding as to the connections and constants which the transformer manufacturers originally intended to be used.

For this reason, we have asked the

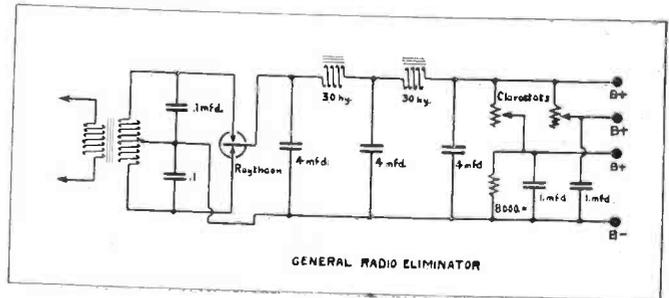
concerns making transformers and chokes for the Raytheon tube to supply us with their own specifications. Therefore, the information given on these pages can be accepted as authoritative, since it comes directly from headquarters. The importance of using the correct circuits and valves has been emphasized by troubles encountered when the wrong parts or wiring have been used.

Both time and money can be saved by making the eliminator exactly right at the start.



General Radio Unit

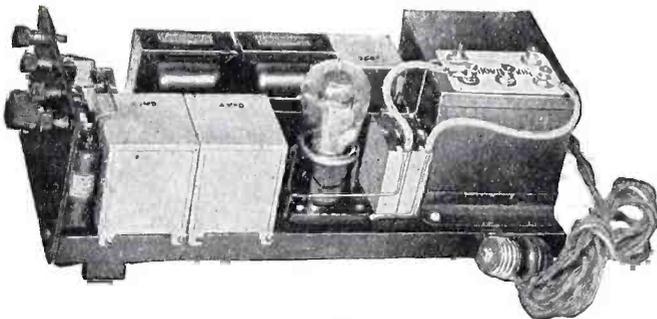
60-mil Raytheon tube—Type 365
rectifier transformer, Type 366 filter



choke. The case of the filter choke includes both 30-henry chokes. Variable resistances for the two amplifier voltages are standard Clarostats.

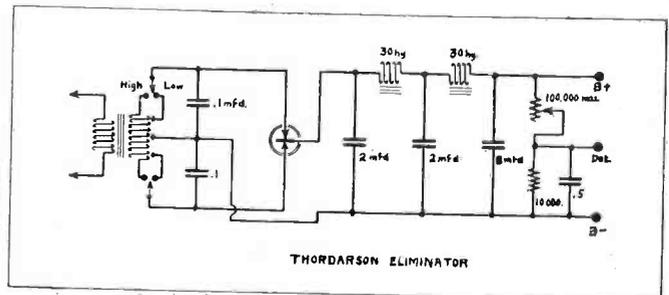
The accompanying illustration shows

the suggested layout for assembling the Raytheon eliminator using General Radio parts. The Clarostats and binding posts for connections to the set are on a small Bakelite panel at the front.



Thordarson Unit

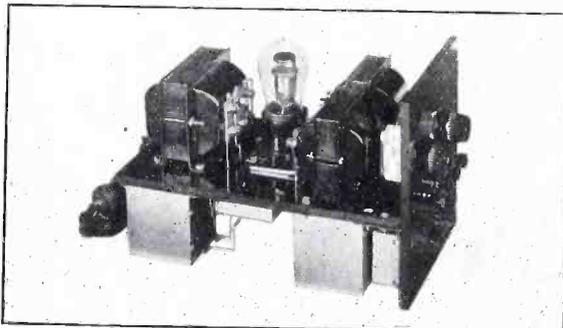
60-mil Raytheon tube—Type R195
transformer, two Type R196 chokes—
one Bradleyohm of 100,000 ohms maximum
resistance.



The Thordarson transformer is provided with two sets of outside taps. For high voltage on sets drawing a fairly heavy plate current, both outside wires should be on the high side. For sets of three or four tubes, or

five-tube receivers using full grid bias, the low taps should be used.

This circuit provides approximately 25 volts for the detector, with a variable voltage for the amplifier tubes, controlled by the Bradleyohm.



Jefferson Unit

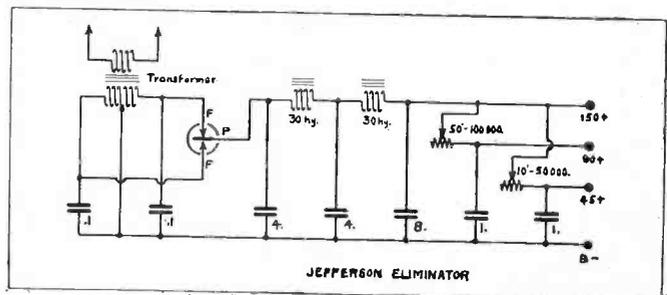
60-mil Raytheon tube—Type 355
transformer, two Type 356
transformers, one Bradleyohm 10,000 to
50,000 ohms, one Bradleyohm 50,000

to 100,000 ohms.

The Type 355 transformer is provided with three lower terminals marked F, C, F. These are on the secondary of the transformer, to supply filament current for a UX-213 tube. With the Raytheon, however, no

connections are made to those terminals.

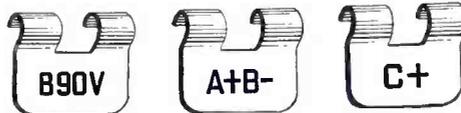
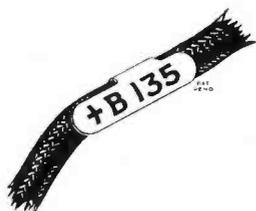
This eliminator provides approximately 45 volts for the detector, 90 volts for the first A. F. amplifier, and 150 volts for the last stage. The two former are adjustable.



SUPREME IN RADIO



CROWE Etched Metal Panels Name Plates Dials



Crowe Cable Markers

are available from stock in 23 standard markings, including +B 135 and -C 22½ for power tubes. Special markings made to order. The new type of marker to the left meets the requirements of manufacturers, where cables must be drawn through holes of small diameter.

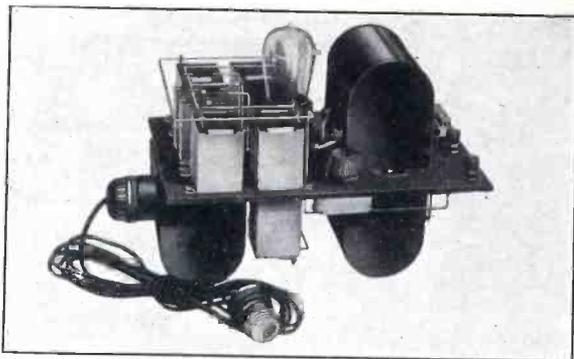
CROWE NAME PLATE & MANUFACTURING CO.

1749 Grace St.

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Chicago



All-American Unit

60-mil Raytheon tube—Type R7 transformer, two Type R8 choke coils.

Mayolian Unit

60-mil Raytheon tube—The wiring diagram given here is for the standard Mayolian eliminator unit. It is also correct for the new Mayolian eliminator parts which are about to be put on the market. The circuit arrangement is slightly different from the others, and it is made to give an extra high voltage on the second amplifier tube terminal for operating power tubes.

Special variable resistances are provided to regulate the amplifier voltages, and to handle fairly high current values.

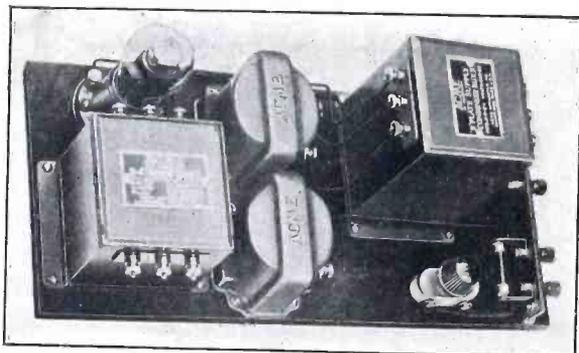
The complete details of the parts

Dongan Unit

60-mil Raytheon tube—Type 1582 power unit for 60 cycles, Type 1594 for 50 cycles, or Type 1595 for 25 cycles. The power unit includes the transformer and chokes in one case. Clorostats are recommended for the variable resistances, or a special Bradleyohm for regulating the high voltage on the amplifier terminal and a No. 10 Bradleyohm for the low voltage amplifier terminal.

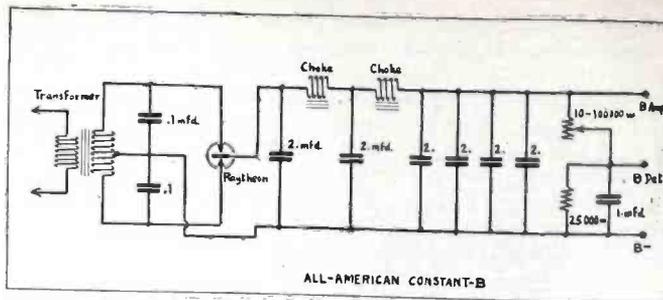
The Dongan Company suggest that the metal cases of the power unit and fixed condensers should be connected to the B-lead, and that one terminal of the A battery be grounded.

Leads from the power unit are



Acme Apparatus Unit

60-mil Raytheon tube—Acme B power transformer, two 30-henry B



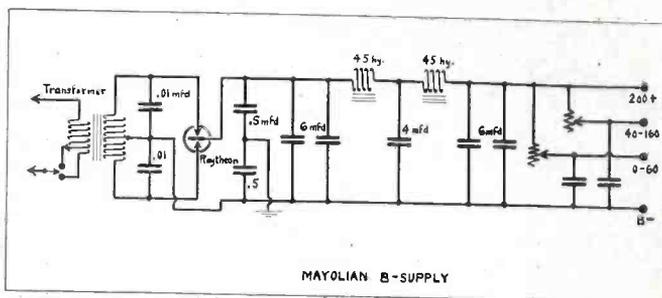
ALL-AMERICAN CONSTANT-B

one Bradleyohm 10,000 to 100,000 ohms.

The transformer is equipped with a cord connection running directly to the lamp socket. One choke is mounted

above the panel and the other directly below.

The All-American Company suggests the use of individual filter condensers of 2.0 mfd., although the standard condenser blocks can be used.

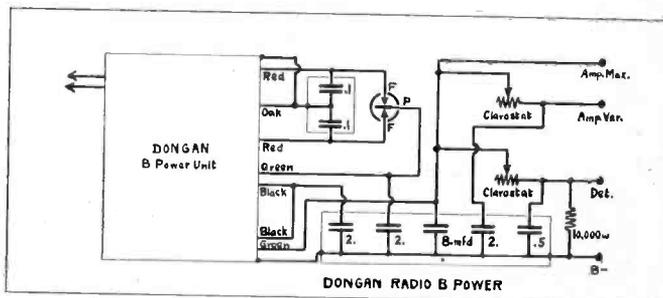


MAYOLIAN B-SUPPLY

are not yet available, but will be given out as soon as they are put on sale.

It should be noted that high and low voltage taps are provided on the

primary of the power transformer. The high voltage tap is to take care of sets drawing an extra heavy plate current.



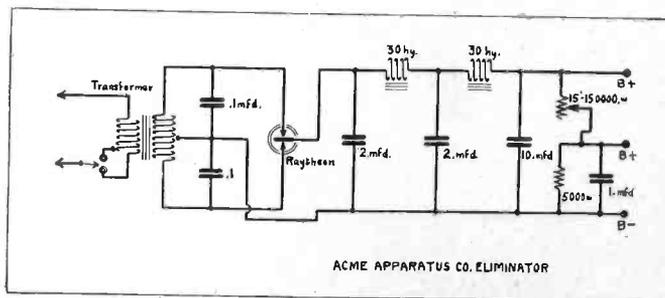
DONGAN RADIO B POWER

designated by their color.

This is a very simple unit to assemble because of the combination transformer and choke unit.

As indicated by the light lines

around the two fixed condenser sections, standard condenser units can be used. The Potter Company makes two units designed specifically for use with the Dongan B power unit.



ACME APPARATUS CO. ELIMINATOR

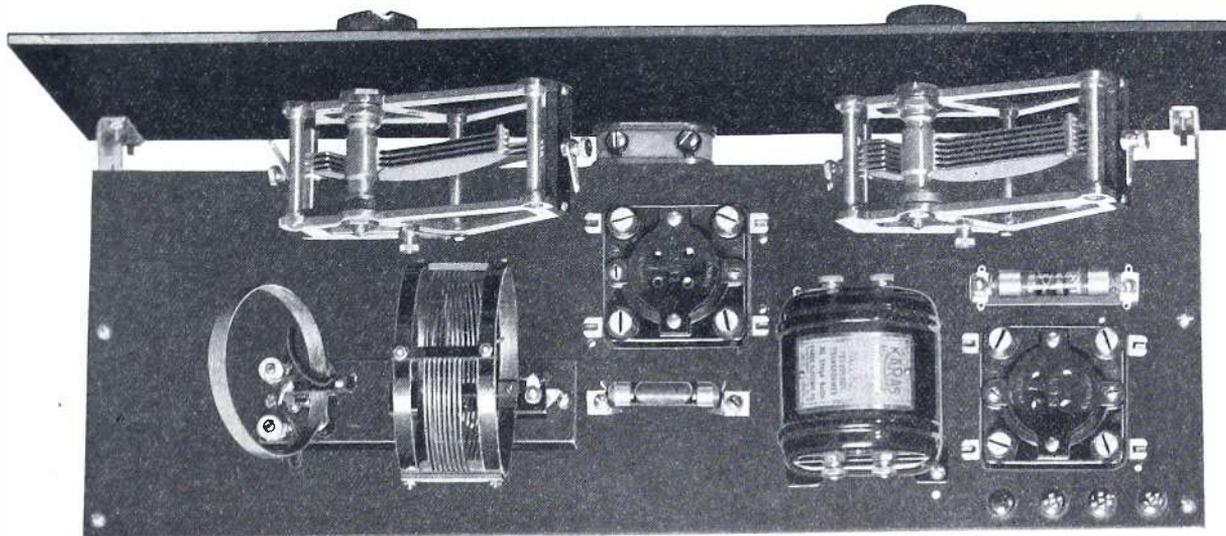
power choke coils, one Bradleyohm 15,000 to 150,000 ohms.

The power transformer is provided with high and low taps, the correct one to be selected in accordance with

the current drain of the receiving tubes.

One amplifier voltage terminal is provided, with a Bradleyohm to adjust the voltage to the correct value.

You'll Use Karas Condensers In Your Short Wave Set



—Put In a Karas Transformer Also

Karas Orthometric condensers with their straight frequency line tuning characteristics are the choice of the leaders in short wave work. Both theoretically and in actual use they have the lowest possible losses—at any frequency. Stations are spread evenly by kilocycles from end to end of the tuning range.

A Karas Harmonic transformer will pass the greatest possible power from detector to audio stage—on any beat note you choose—with the least distortion if you're using voice. Make it an all-Karas job and get the benefit, in the head phones, of every bit of energy reaching your antenna.

5-plate Orthometric (.0001) price \$6.50; 7-plate (.00014) price \$6.50; 11-plate (.00025) price \$6.50; 17-plate (.00035) price \$6.75; 23-plate (.0005) price \$7.00.

Order Through Dealer, or Direct on This Coupon

Karas Condensers in the 23, 17 and 11 plate sizes are sold by good Radio Parts Dealers in most cities. The 7 and 5 plate sizes are not so widely stocked by dealers. Orders will be filled direct, or may be placed through your dealer and his jobber. If you prefer to order direct, use this coupon. Send no money. Just pay the postman the price plus a few cents postage.

KARAS ELECTRIC CO.,

Manufacturing Plant: N. Rockwell St.
Offices: 1060 Association Bldg.,
Chicago, Ill.



Karas Harmonik Transformer, price \$7.00

Karas Electric Co.,
1060 Association Bldg., Chicago.

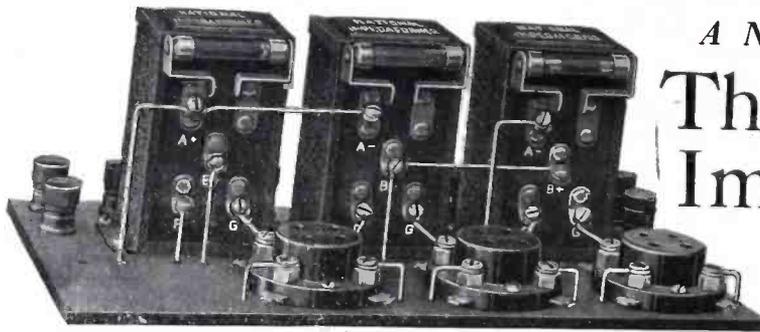
Please send me Karas Harmonik Transformers and Karas Orthometric Condensers, sizes as checked below. I will pay the postman the price plus postage upon delivery. It is understood that I have the privilege of returning these condensers and transformers for full refund any time within 30 days if they do not prove entirely satisfactory.

..... 5 plate; 7 plate; 11 plate;
..... 17 plate; 23 plate.

Name

Address

If you send cash with orders we'll ship condensers and transformers postpaid.



A New National Radio Product
**The NATIONAL
 Impedaformer**

*marvelously improves
 the home-built set*

The Illustration Shows the Assembly of Three Impedaformers
 as They Would Appear in a Set

**Inductive Audio
 Flat Curve**

The NATIONAL Impedaformer is an inductance-capacity-resistance unit that actually gives a flat curve over the entire audible frequency range.

Includes choke coil, grid condenser and grid leak built into a single unit so that its connections are the same as an ordinary transformer.

Made in two types: Type A (choke coil only). Price \$4. Type B contains choke coil with grid condenser and grid leak. Price \$5.50.

Our advertising in leading radio publications is directing customers to your store for this new NATIONAL product.

Send for Bulletin 108 RE

*The Impedaformer Sets a New Standard of
 Radio Reproduction*

"I have just heard the finest reproduction of voices over the radio," writes a well-known radio expert to the National Company. "The set was equipped with the new impedaformer. I was amazed at the refinement of delivery."

With these units an impedance coupled audio amplification system can be constructed which will truthfully and uniformly reproduce in all its richness and purity each and every note sent out by radio-casting stations.

The tone quality is simply superb. The volume is greater than with resistance-coupled amplification. And this is accomplished with no more B battery voltage than is usually used on a transformer system and with a minimum of storage battery consumption.

NATIONAL COMPANY, Inc.

W. A. READY, President
 110 Brookline St., Cambridge, Mass.

**Immediate Delivery on
 DONLE TUBES**

For louder signals
 better signals on
 all types of sets
 using Neutro-
 dyne, Tuned R.
 F. or Regenera-
 tive circuits.

PRICE \$5.00

Dealers: To give you a chance to introduce the Donle Tubes to your trade, we will ship 2 Donle Tubes upon receipt of your check for \$7.00 provided the order is on your business stationery, and signed by the manager. On subsequent orders, 30% discount will be given only in lots of six tubes—cash with order.

C. J. BROWN, Authorized Agent
 17 West 51st St. New York City

**SCREW MACHINE
 PRODUCTS
 & SPRINGS**

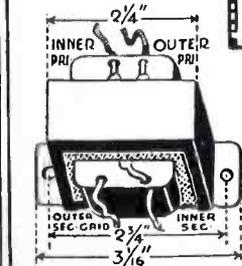
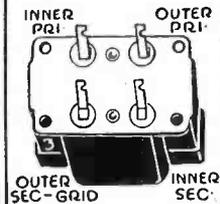
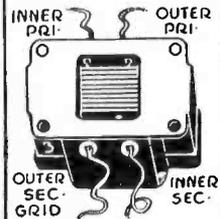
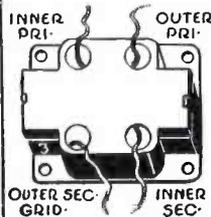
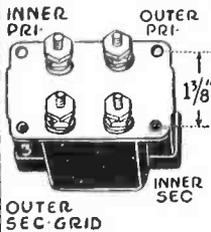
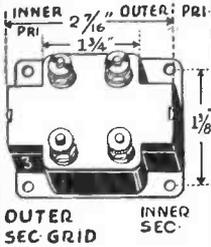
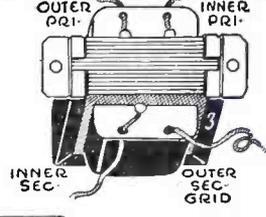
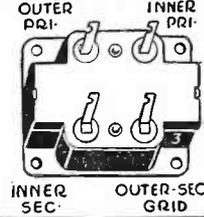
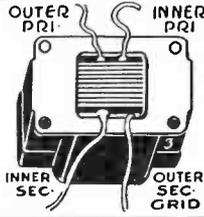
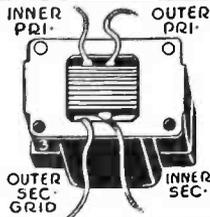
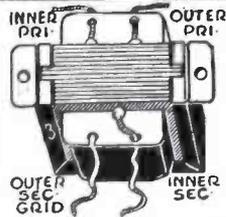
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 297 Washington St.
 NEWARK :: :: N. J.
 TEL. MARKET 9077

**210 POWER
 AMPLIFIER
 DATAPRINTS**

Better Quality from Any Set
 Works on 110 Volts, 60 Cycles

\$1.00

M. B. SLEEPER, Inc.
 A-52 Vanderbilt Avenue, New York City



THORDARSON

R-200 AMPLIFYING TRANSFORMER

The Thordarson R-200 amplifying transformer is designed for the musical epicure—for the man who prefers his radio music unadulterated by distortion. The R-200 reproduces every note from deep into the bass to above the upper range of the ear, with true quality and timbre.

The R-200 is available to set manufacturers and consumers alike. There are more Thordarson transformers used in quality receiving sets than all competitive transformers combined. Whether your set is factory built or home-made, insist on Thordarsons and you will have a real musical instrument.

Note to Set Manufacturers
There are more than 100 different types and mountings of Thordarson transformers available for the Set manufacturer.



Autoformer Impedance Amplifier

All frequency amplifier. A Step-up impedance combining the amplification increase of the transformer with the uniform reproduction of the impedance.

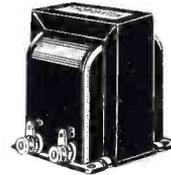
Price \$5.00



B-Eliminator Transformer

(Raytheon type) designed to give steady B voltage. Absolutely silent in operation. Capacity in excess of any receiver. Will not heat up in continuous service.

Price \$7.00



30 Henry Choke

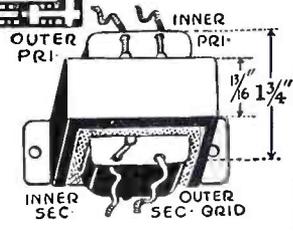
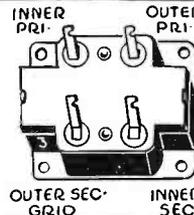
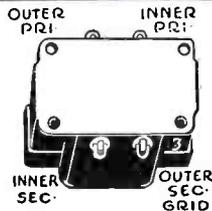
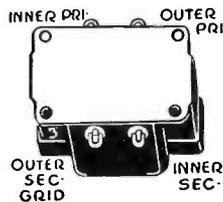
Designed for filter circuits of B-eliminators and power amplifiers. Capacity 70 milliamperes. D.C. resistance 280 ohms. Core tightly clamped.

Price \$5.00

THORDARSON ELECTRIC MANUFACTURING CO.

Transformer specialists since 1895

WORLD'S OLDEST AND LARGEST EXCLUSIVE TRANSFORMER MAKERS
Chicago, U.S.A.



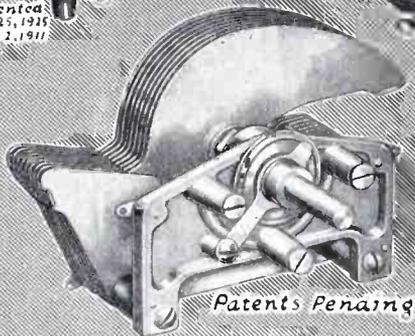
Essential to Better Radio Sets



Patented
July 23, 1915
No. 2,191



Licensed Under
Lovejoy Patents
Nov 3 1925



Patents Pending

Radio sets of today are very simple when compared to those of yesterday. This simplification has only been achieved by the finer, more delicate and more efficient parts that go into the make-up of the set.

Benjamin Radio Products have set up such high standards that many of the country's greatest radio authorities have continually advised and used Benjamin Radio Parts in their newest and best radio creations. They are essential to better radio sets, being built for the years to come.

This is one of your biggest fields for profits—not potential, but actual! Your trade knows Benjamin Radio Products and it uses them in ever-increasing volume. Don't let these profits slip through your fingers.

Ask to be sent the Benjamin Better Radio Literature. It is gratis and an exceptional source of information to dealers.

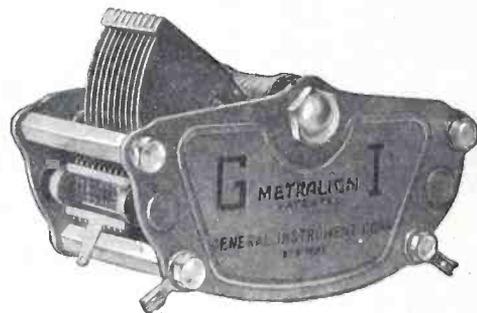
Benjamin Electric Mfg. Co.
120-128 So. Sangamon Street
Chicago

New York: 247 W. 17th St.
San Francisco: 448 Bryant St.

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Benjamin Electric Mfg.
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BENJAMIN

Here Is The Answer To Your Condenser Problem-- Also Your Sales Problem



METRALIGN

SLT Straight Line Tuning

To equip your set with METRALIGN SLT condensers, is to give it that long sought for ease and accuracy in tuning that will break down all sales resistance.

It has remained for General Instrument engineers to develop the only capacity unit that forever solves the tuning problem, by insuring perfect station separation over the entire broadcast band.

METRALIGN

SLT

Exclusive Features

- Perfect Rotor and Stator Alignment
- Smallest Physical Dimensions
- Featherweight
- Single or Triple Hole Mounting
- Ball Bearing Rotor
- Short Circuits Eliminated by Mechanical Equalizing Members on Rotor and Stator.

Get the complete METRALIGN SLT Story. Write for booklet today.

GENERAL INSTRUMENT CORP.
(Manufacturers of "Bureau of Standards" Variable Primary Condensers)

477 Broadway, New York City.

Makes any set a new set—in 15 minutes

NEW



for
Manufacturers
of
Receivers—Speakers

THE
BEST
CONE TYPE UNIT

is now in production. The economy of cost and improvement in tonal quality is such that you must inspect this new development.

ALSO
**BALANCED ARMATURE
UNIT**

which by rigid tests, made by recognized laboratories in different parts of the world surpasses any unit now made. You should have further information.

Complete assortments on all types. Built-in designs, etc.
Special Designs to Specification

Reputable Jobbers and Dealers—Write!

BEST MANUFACTURING COMPANY
1200 Grove St. Irvington, N. J.
"All That The Name Implies."

Sales Department
The Hartzell Sales Company
961-50 Church Street, New York City, N. Y.

QUALITY

*That's What You
Want to Hear!*

AND you can get it—quality such as you never heard before. How? With the 210 Power Amplifier.

SO astonishing has been the demand for parts to build the 210 Power Amplifier, and so enthusiastic the reports from those who already have them in operation, that DURRANT has placed orders far in advance to insure prompt shipment to every customer.

ONE man wrote—"My neighbor built the 210 and, since I heard it. I haven't the nerve to let anyone hear my set again until I can give them that 210 Power Amplifier Quality."

210 POWER AMPLIFIER CONSTRUCTION KIT

Every part, including panels drilled and engraved (except tubes) with official Dataprints O. K'd by J. L. Schermerhorn, Chief Engineer of the American Transformer Company. 210 Power Amplifier Kit, ready to assemble..\$67.50

RX-1 RECEIVER

Complete kit for the RX-1 high-quality non-regenerative receiver\$32.50

DONLE DETECTOR TUBE

For RX-1, neutrodyne, tuned R. F., and regenerative sets specially tested on our own equipment\$5.00

DURRANT RADIO, Ltd.
EQUIPMENT FOR SET BUILDERS
T-52 Vanderbilt Ave., New York



No. 135-C Portable Radio Voltmeter "De Luxe"

Our new 135-C portable voltmeter illustrated above is the most beautiful radio instrument manufactured. The case is of genuine black bakelite. The scale is silvered with black characters and the movement parts are also silvered. It is supplied with long cords with tips for plugging into the 'phone jacks, now provided on many sets. All Jewell instruments are supplied with zero adjusters.

Send for New Jewell Radio Catalog
No. 15-C; now on the press.

JEWELL ELECTRICAL INSTRUMENT CO.

1650 Walnut Street, Chicago
"26 Years Making Good Instruments"



Radiohms and Potentiometers

Centralab non-inductive, variable resistances are controls of graphite type that insure smooth, noiseless tuning and *permanent service*. A single turn of the knob gives stepless variation of resistance from zero to maximum.

Centralab Radiohms have two terminals, and can be furnished with maximum resistances of 2,000, 25,000, 50,000, 100,000 or 200,000 ohms. Centralab Potentiometers have three terminals, and are furnished in resistances of 400, 2,000 and 500,000 ohms. There is a type adapted to every radio circuit for control of oscillation or volume.

Write for literature describing these and other Centralab super-quality radio Controls.

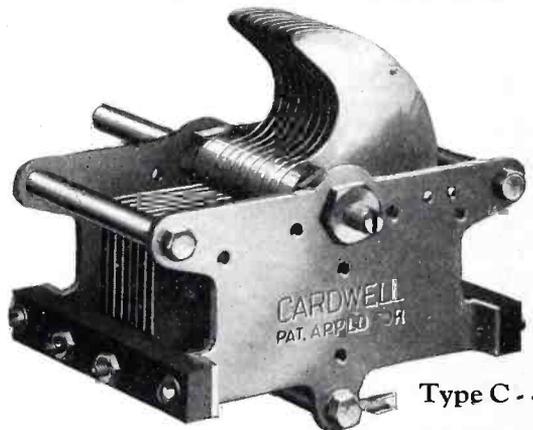
CENTRAL RADIO LABORATORIES
25 Keefe Ave. Milwaukee, Wis.

Centralab

"INSTRUMENTS ARE NECESSARY"

Engineers, experimenters, amateurs and service men all realize the value of instruments and we ask that you help us in our effort to improve radio reception by a more intelligent and careful control of radio sets. In designing new sets, servicing old and instructing owners in the operation of their sets you can point out the value and use of instruments.

Cardwell Condensers



Type C..

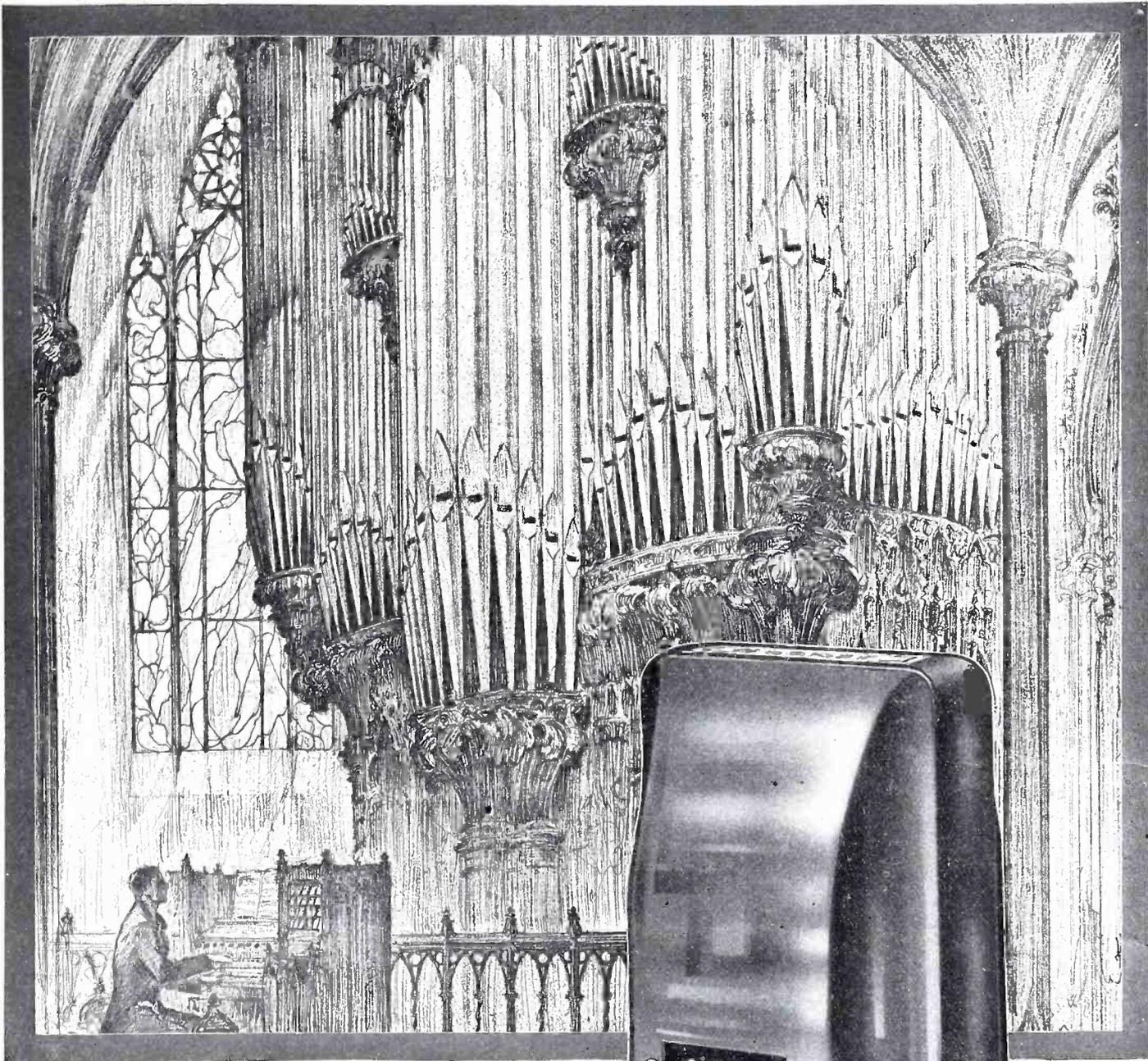
The Manufacturers Favorite

with the Ideal Tuning Curve
IN SINGLES and MULTIPLES

Send for Quantity Prices

The Allen D. Cardwell Mfg. Corp.
83 PROSPECT STREET BROOKLYN, N. Y.

"THE STANDARD OF COMPARISON"



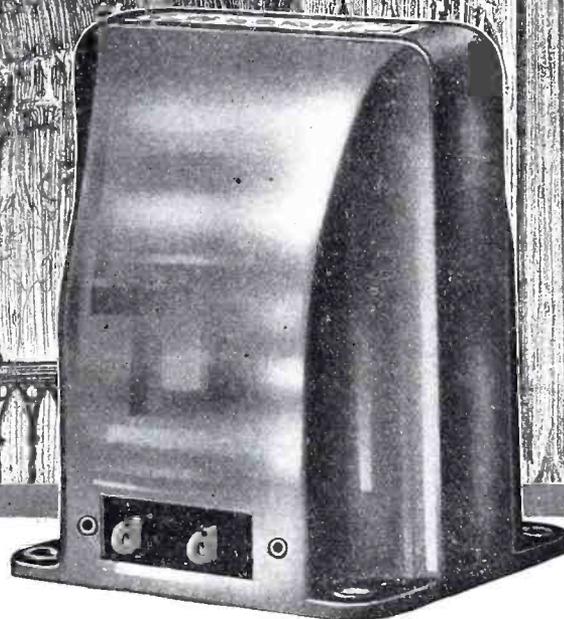
Samson Audio Units

are capable of uniform and faithful amplification well in excess of the most exacting broadcast requirements.

Their range extends from the lower fundamentals through the higher harmonics, enabling them to reproduce the lowest rumble of the tom-tom or the thinnest shrill of the flute with equal clarity.

This ability to reproduce the harmonics or higher multiple frequencies is what gives tone-color or background to sound—is what permits the listener to distinguish notes of the same pitch but from different instruments—results not possible with audio units which cut off at comparatively low frequencies.

Our book—"Audio Amplification"—already accepted as a manual of audio design by many radio engineers—contains much original information of greatest practical value to those interested in bettering the quality of their reproduction. Sent upon receipt of 25c.



SAMSON AUDIO UNITS

In a word—when working with a loud speaker of corresponding range—insure the sort of radio you've hoped to hear—the quality of radio that will make you think you've been translated from a broadcast listener to one of an audience which is listening, first-hand, to a speech or to music.

For 1926-27 the Samson Electric Company offers eleven different audio units:

Symphonic Transformers	Type X	\$9.00
Push-Pull Input Transformer	Type HW-A3	5.50
Standard Transformers	Ratio 2-1, 3-1, 6-1	5.00
Dual Impedance	Type D	5.00
Output Impedance	Type O	5.00
Push-Pull Output Impedance	Type Z	5.00
Plate Impedance	Type P	4.50
Grid Impedance	Type G	4.50
Audio Frequency Choke	Type No. 3	3.00

SAMSON ELECTRIC COMPANY

Main Office, Canton, Mass. Factories, Canton, Watertown, Mass.

Manufacturers
Since 1882

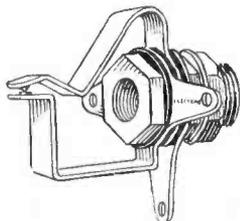


ELECTRAD

ELECTRAD Certified Jacks

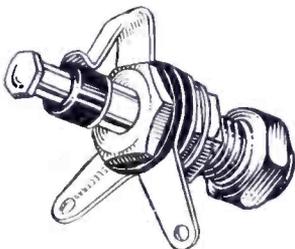
Open and Closed

POSITIVE acting spring of phosphor bronze. Insulation of hard rubber. Tinned soldering lugs, placed to make good connections easy. Sterling silver contact points. Requires less than 1" behind panel. Certified and guaranteed electrically and mechanically. List, open 25c, closed 35c. In Canada, open 35c, closed 50c.



ELECTRAD Certified Switches

When they're on, they're 100 per cent on; when they're off, they're 100 per cent off. Solid brass construction. Tinned soldering lugs, placed to make good connections easy. Neat design, genuine Bakelite knob. Require less than 1" behind panel. List 40c—in Canada 60c.



Write for details of our square dealer proposition that helps you sell and protects your profits.

Write for information on the Electrad 500,000-ohm compensator for perfect control of tone and volume. 428 Broadway, New York City.



ELECTRAD

Mr. Radio Engineer

- To—Simplify set operation.
- To—Solve all tube control problems.
- To—Avoid the possibility of distortion in reception.
- To—Decrease servicing need.
- To—Lower production costs.

COMMUNICATE—with an organization that has specialized in filament control ever since Radio was born.

Radiall Company

50 Franklin St., New York, N. Y.

Makers of



The "SELF-ADJUSTING" Rheostat

MUTER

DEPENDABLE FIXED CONDENSERS

MICA INSULATION
BRASS ELECTRODES
ACCURATE CAPACITIES



Used by Leading Set Builders

SAMPLES AND QUOTATIONS
PROMPTLY FORWARDED

LESLIE F. MUTER COMPANY
76th AND GREENWOOD AVE.
CHICAGO ILLINOIS

NOW READY

NEW 1926-7 CATALOG

WRITE FOR A COPY



CLAROSTAT

THE UNIVERSAL RANGE VARIABLE RESISTOR

\$2.25

DEALERS and JOBBERS—

Power supply is the biggest development this year. Raytheon publicity in scores of magazines and newspapers has specified Clarostat as the only variable resistor for battery elimination. Your customers will demand it this fall. Write us now.

ENDORSED and USED by

Acme Apparatus
All-American
Amertran Cooper
Dongan
General Radio
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Jefferson
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MANUFACTURERS—

Clarostat has a universal resistance range of from practically 0 to 5,000,000 ohms—a current-carrying capacity of 20 watts—is absolutely noiseless in operation—and requires but one hole for mounting.

Special types of Fixed and Variable Resistors to meet any and all requirements of Receiver and Power Supply Manufacturers.

AMERICAN MECHANICAL LABS., Inc.

285 N. 6th ST., BROOKLYN, N. Y.



\$2

CARTER "HI-OHM"
(full size)

NEW VOLUME CONTROLS

CARTER "HI-OHM" and "HI-POT"
500,000 OHMS

"HI-OHM" a non-inductive, variable, wire wound resistance 1 1/2" dia. Projects 3/8" back of panel. The contact arm slides on protecting wires covering the special moisture proof resistance element, eliminating wear and assuring long life and unvarying electrical characteristics.

"HI-POT" same size with third terminal, \$2.25. Write for illustrated folder of full description and circuit diagrams.

Resistance in both "HI-OHMS" and "HI-POTS" for special circuits: 300,000; 200,000; 100,000; 50,000; and 10,000 ohms.

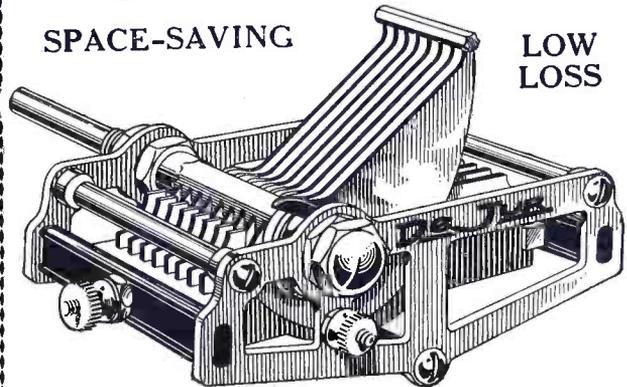
In Canada:
Carter Radio Co., Ltd.
Toronto



DeJUR STRAIGHT LINE FREQUENCY CONDENSER

SPACE-SAVING

LOW
LOSS



Occupies No More Space Than Old Type Condensers

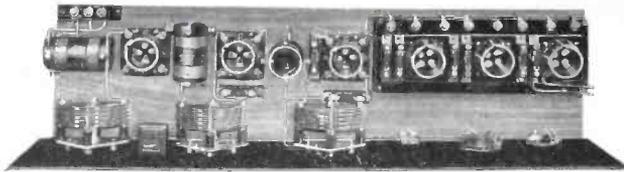
Attractive heavy weight brass stator and rotor plates scientifically placed in relation to each other. Genuine Bakelite moulded insulation throughout. Rotor and stator plates swedged in by hydraulic pressure to insure permanent, perfect alignment. Stator plates rotate on ball-bearings. End plates are of brass, highly finished in solid nickel, buff polished. Grounded rotor with spring phosphor bronze pig-tail connection. Special guard on shaft prevents rotor plates from contact with frame posts. All body capacity effects and electrical annoyances during adjustment are eliminated.

Made in all standard sizes and in Single, Double and Triple types.

Get our quotations for your requirements.

DeJUR PRODUCTS CO.

"The world's largest manufacturer and exporter of radio products."
199 Lafayette St. New York City



Daven Bass Note Circuit Demonstration Set — shown from above

Dealers are Demanding Daven Demonstration Sets

*Bass Note Circuit
Exciting Fan Interest Everywhere*

HAVE you secured your Daven Bass Note Demonstration Set? If not, get in your order at once!

We had no idea, when we first decided to supply dealers with this aid to quick sales, that it would create such a demand.

F. Schober of the Englewood (N. J.) Radio Service, reported the sale of six Daven Bass Note Circuit Kits the first day he had the Daven Demonstration Set in his window. C. W. Butts, of East Orange, N. J., sold fifteen sets of parts. From this you can see something of the way fans are taking to this new hook-up.

Radio publications everywhere are telling the public about this unique circuit. Your customers will be asking to hear it. We supply the set, *for dealers' use only*, at our actual manufacturing cost of only \$50. Send an order to your jobber today for this newest business builder.

The Daven Units Required to Build the

DAVEN

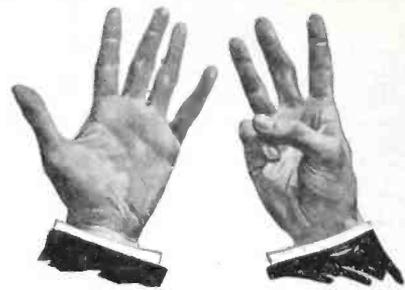
BASS NOTE CIRCUIT

- | | | |
|-------------------------|----------------------------|------------------------------------|
| 1 Set D.R.F. Coils | 1 Daven MU-6 Power Tube | 1 Daven ½ Ampere Ballast |
| 1 Daven Super-Amplifier | 1 Daven Leak-denser No. 22 | 1 Daven Special Type "A" Condenser |
| 3 Daven MU-20 Tubes | 1 Daven ¼ Ampere Ballast | |

"The Sine of Merit"

DAVEN RADIO CORPORATION

TRADE MARK "Resistor Specialists" REGISTERED
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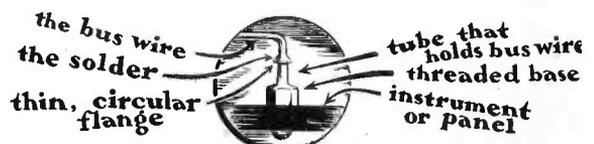


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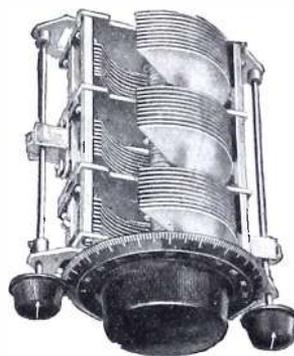
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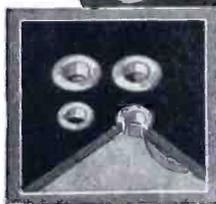
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Under
side of
sub-panel

Top view



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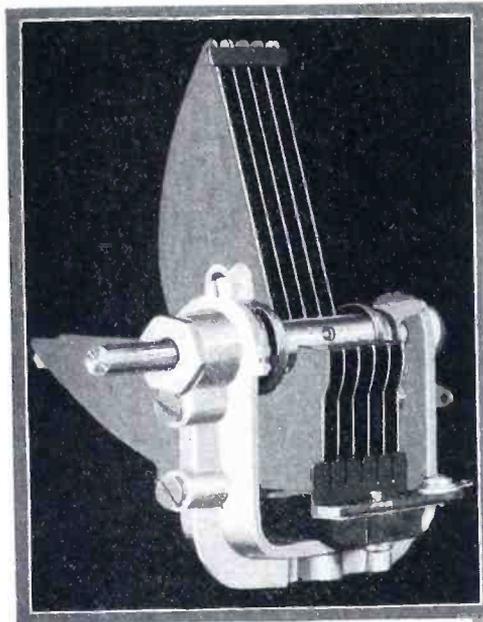
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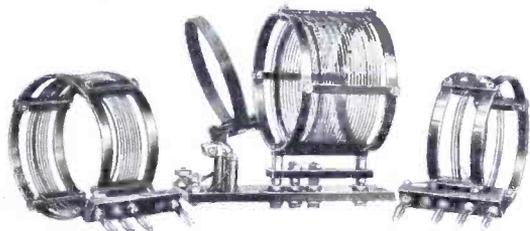
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AERO COILS Give Best Results—Always!



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Raytheon equipped, the Majestic "B" Current Supply delivers uniform, constant, "B" power direct from the light socket. It improves reception. Operates at an average cost of only one-tenth cent an hour.

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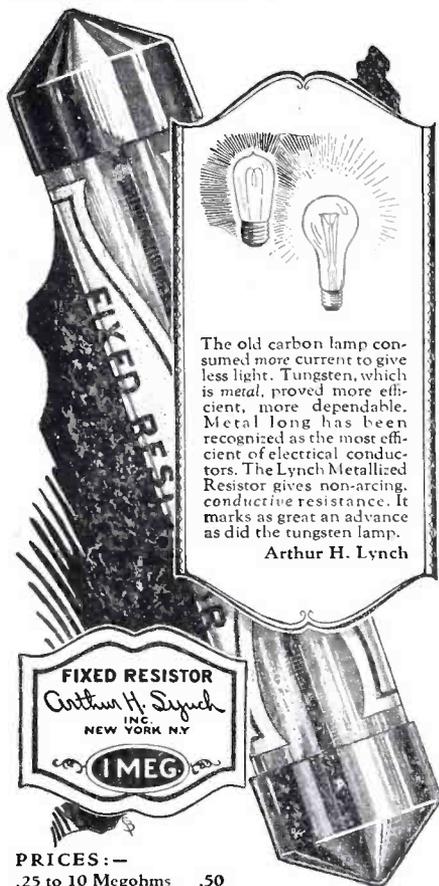
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STRAND—Antennae (plain or
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The LYNCH METALLIZED RESISTOR



The old carbon lamp consumed more current to give less light. Tungsten, which is metal, proved more efficient, more dependable. Metal long has been recognized as the most efficient of electrical conductors. The Lynch Metallized Resistor gives non-arcing, conductive resistance. It marks as great an advance as did the tungsten lamp.

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 Permanently Accurate
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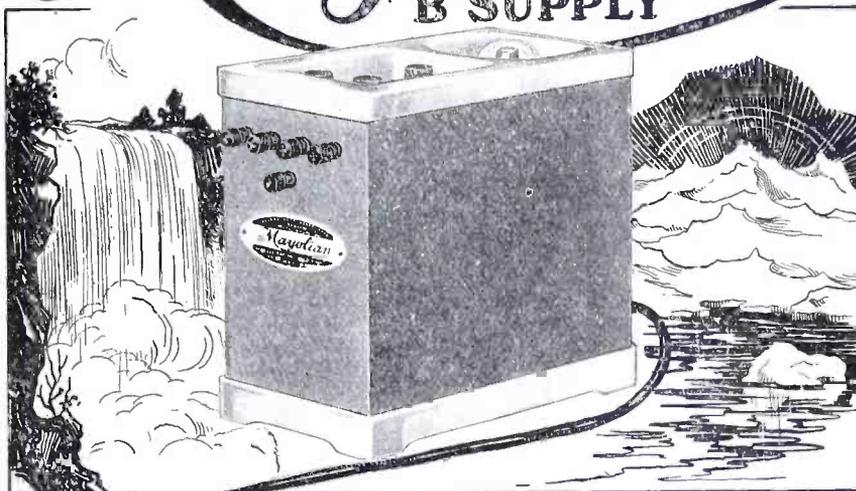
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Radio Engineering, July, 1926

Mayolian "B" SUPPLY



*The Power
of Niagara*

*The Quiet of
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**ABSOLUTELY SILENT OPERATION
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Greater Volume — Better Tone

MAYOLIAN, in addition to giving your receiver silent, unfailing "B" current right from the light socket, improves tone quality and gives more volume because its voltages are adjustable to the operating characteristics of any receiver or set of tubes. Delivers the highest "B" output—180 Volts!

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Pioneers in Battery Elimination

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NEW YORK, N. Y.

The "B" Without a Buzz



Operates at half the cost of a 25-Watt lamp



SM

"Plug-In B"

The Silver-Marshall type 650-B gives the highest power, the best regulation (constant output) regardless of number of tubes used, and greatest freedom from hum of any power supply you can buy. It will supply from 25 milliamperes at 300 volts to 90 milliamperes at

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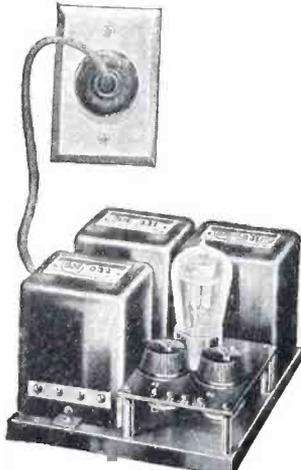
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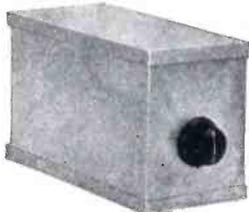
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The 220 and 221



The Shielded Stage

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Please send me "The Secret of
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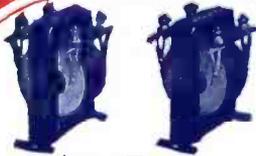
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AmerTran DeLuxe
In two types \$10.00 each



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110, 118, 125—525—8 4-8 4

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Type 854

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